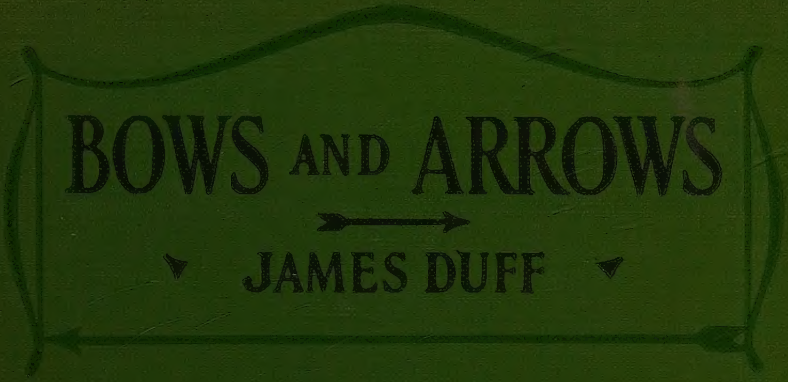

BOWS AND ARROWS

JAMES DUFF

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BOWS AND ARROWS

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James Duff, photographed by A. Shepherdson, Melrose, Mass., on his winning the Eastern Championship, 1916, Newton Centre, Mass.

BOWS AND ARROWS

HOW THEY ARE BEST MADE FOR ALL KINDS OF TARGET SHOOTING

INCLUDING CHAPTERS ON SHOOTING,
ACCESSORIES AND COMPETITIONS

BY

JAMES DUFF

FORMER PRESIDENT, NATIONAL ARCHERY ASSOCIATION

EDITED BY EDWARD CAVE

ILLUSTRATIONS BY G. P. HAYNES

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PREFACE

Through all the ages since the beginning of the art of shooting with bow and arrow, the manner of making the implements of the art always has been of great importance to the success of the archer. And yet, among all the writing that has been done on the subject of archery, there is extremely little to be found from the pens of qualified craftsmen, or bowyers, in this work. It is for this reason, rather than from any thought of presenting a claim to being an authority on archery, that the present writer has mustered the temerity to stand with the many who have known the sport of archery so well as to have written authoritative books about it.

Having been occupied at making bows and arrows for upwards of thirty years, and having attained to the distinction of supplying the equipment of the most able archers for tournament use, I have of course acquired a fund of practical knowledge, based upon experience, observation and study, which makes me at home among the authorities. And I may as

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well admit that I enjoy their company. But as for posing as one of them, perhaps I can best explain my diffidence by telling a little story out of my own experience.

When I was a boy in Scotland, sometime about the year 1892, while employed in the Archers' Hall, in Edinburgh, under Mr. William Fergie,—a name well known in archery circles for many years,—I was present one day when a visitor came and set Mr. Fergie a queer task. He was Professor Tait, of Edinburgh University, and he explained his intention of proving how far a golf ball could be driven. He set Mr. Fergie the task of making a bow strong enough to throw a golf ball a distance of 100 yards.

In due time a bow was made, of 75 pounds pull, and in the center of the string was set a block of wood to drive the golf ball with. But after months of effort, Mr. Fergie and his assistant, Dick Thompson, appeared convinced that the attempt was a failure. The apparatus did not seem able to throw the ball farther than 60 yards, which was the full length of the grounds, but at that not a direct hit, only accomplished with a run.

Being only an apprentice, I of course had nothing to say. But I nevertheless was doing considerable thinking. Somehow or other I had learned that centuries ago the same sort of machines had been used to cast heavy stones from the walls of castles under assault, and I could not understand why the apparatus could not throw so light a missile as a golf ball much farther. I quietly visited the Museum and made a careful study of some of these old-time weapons, under the watchful eye of the attendant, and I made, as I thought, a discovery. After watching Mr. Fergie and Thompson make their last attempt, I plucked up courage to say: "I think I know what is wanted, Mr. Fergie."

The boss set me down with disdain, remarking that he would do the thinking and I had better get back to my work.

But the following week, while he was away attending his weekly golf party, I broached the subject to Dick, and obtained his permission to take the bow-gun out and try what I could do. It did not take me long to find out! After altering the apparatus to suit my ideas, I had a try—and immediately thereafter sneaked the machine back indoors and went back to my bench without saying anything.

With a smile Dick asked, "Well, did you exceed the 60-yard mark?"

I replied that I had.

He expostulated that it was impossible—that 60 yards was the limit of the grounds.

"But," I replied, "I sent the ball through a window at the top of the building!"

Professor Tait's machine was a success, thanks to the observation of a boy who had caught the hang of doing a little connected thinking.

And so, while a great deal of what is said in this book may be written with an air of much conviction, I wish to assure my readers that it is far from my desire to have what I may say accepted as the final word. Rather, I ask to be borne with when I may seem overpositive, and indulged for omissions, it being remembered that my trade is that of making bows and arrows, not writing books.

Let it not be assumed that any man knows it all, or that any past authority was infallible. Judge for yourself and draw your own conclusions. If in the end you can accord a fair amount of credence to the man who manifestly has been through the mill, then the purpose of this book is accomplished.

For another thing, I realize that the reader may very soon form the opinion that I have little reverence for tradition. However, as to this I ask that it be remembered that I do not write as a compiler, in the atmosphere of the library. Instead, this book is intended as a simple manual of practical information, with a strong workbench flavor, presenting what I consider may help archers in general the better to know and enjoy their sport. It is not, I may add, one of those controversial books, that condemn all contemporary works and weave a halo over everything that is long past and gone. Nor is it meant to broadly cover the whole subject of archery. There already are excellent books, modern and exhaustive, which serve that purpose. I refer especially to those by Elmer, McMeen, and Pope.

To the reader who wishes to learn about archery in the same spirit as that shown by the archers who come to my shop, and those who consult me at the tournaments and by letter, I hereby extend my devotion. This is your book. I hope you find in it a good share of the inspiration and help you seek as a student of our grand old sport of shooting with the long bow. If there are any questions you would like answered—as I fear there may be, there being so very much to be said which at the time of writing does not occur to me—by all means write to me. I shall do my best to make due amend for my shortcomings as an author.

JAMES DUFF.

Jersey City, N. J.

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James Duff Photographed by A. Shepherdson, Melrose, Mass., On His Winning the Eastern Championship, 1916, Newton Centre, Mass. . . . . . *Frontispiece*

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BOWS AND ARROWS

BOWS AND ARROWS

CHAPTER I

INTRODUCTION

As a craftsman, practicing the art of bow and arrow making for a living, I shall first discuss the archer's equipment. Such reversal of the usual order may tend to create the impression that I place skill and judgment in making the tools of archery ahead of skill and judgment in using them. This, however, is not the case. And although I may say I have nearly all my life been an archer of fair accomplishment, and have witnessed a great deal of good shooting, and enjoyed the acquaintance of a great many very able archers, I have no strong inclination to teach others to shoot, least of all to teach by means of a book. There are many better qualified, and such instructions on shooting as I give in a later chapter are to be considered as covering the essentials rather than the fine points.

And now as to making the archer's tools.

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As I pause to consider where to start, I am reminded strikingly of the visitors who for many years have come to my workshop. These vistors are of all kinds, with a generous sprinkling of expert archers. And invariably, while making what is obviously a fraternal call in connection with placing an order for a bow, some arrows, or both, there is an irresistible desire to deeply probe the bowyer's knowledge of his art. Not a few of them seem to enjoy putting the man of sawdust and shavings through a sort of third degree. And invariably at the end of the interview, with an expression of thanks for the information obtained they leave with an air of having expected considerably more—as if suspecting the bowyer could have divulged many a secret had he been good enough. Yet there is nothing about the bowyer's art that need be guarded as a state secret, and one might readily tell every trick of the trade. But the bowyer is not paid for giving lectures; and remembering the cost of living, and the urge of sundry orders to be filled, he is reminded to get on with the work. Happily now, so far as I may have sinned in this direction, perhaps some omissions of information that have occurred are made up for in this volume.

As my experience has taught me that bow making easily comes first in importance, I shall take this up first. And here once again perhaps I may be excused for commenting on the ways of customers, for the benefit of the moral that is pointed. I have rated bow making as first in importance; but this is to be qualified. Very often the bow maker receives an order such as follows:

"Please send me a bow of such a length and weight, and the material for making a dozen best arrows, as I want to make the latter myself." These customers—and there are very many of them—consider bow making too big a job for them, but are sure of their ability to turn out "best" arrows. To the professional, however, this is amusing. Because he knows that a professional who knows his business can make a fair living at bow making, but an arrow maker has to grind hard and long, even with all his knowledge and skill, to make bare day's wages. The latter work is tedious and slow unless machinery is introduced—and machine-made arrows are unsatisfactory to the expert archer, who is the only customer who realizes the value of good arrows sufficiently to pay for them. To the professional, making arrows is no joke. He is ready enough to let his customer start out to "make his own," knowing full well that in due time the drudgery will come to him—from one more customer who has learned, in the best way, how to appreciate a real good arrow.

In bow making, machinery is just as positively barred out. A circular saw may be used to advantage for cutting out the stave from the billet. After laying out the bow from a template laid on the stave, a circular saw or a band saw can be used for cutting out along the bow lines. A jointer is a perfect machine for dressing the back of the bow, and for taking off the outer edges. A novelty machine serves admirably for shaping the belly. These are all standard machine tools, and can be found almost anywhere. Doubtless they are used to more or less extent where bows are manufactured. But bow making for serious archery is not a manufacturing job, the manufactured article failing utterly to come up to requirements. The use of these machine tools for producing a weapon of any high value is prohibited by the very purpose for which the bow is made. A bow is an instrument depending for its quality upon its ability to bend like a flat spring, and do so along well defined lines—and the tree does not grow that will provide wood so perfect that the many advantages of machinery can be utilized for shaping this large wooden spring as it must be shaped to do its work properly.

After cutting out his stave with a saw, your old-fashioned bowyer proceeds to shape it in the rough with a hatchet or hand ax. To persons who have never seen the work done this is a statement which causes considerable surprise. Why use so crude a tool? is the question. The answer is simple enough. The bowyer's reason for using his hatchet is to him at least a good one. He knows that a machine would trim the stave down cleaner and more quickly, but he also knows that it would cut the wood irrespective of how the grain ran and without attention to flaws if any there were. And he knows that after considerable time and effort had been spent, he might have to discard the bow as useless. On the other hand, his ax will find any defect in the wood almost at once; it will follow the grain, and if this is cross the work ends with the chop that reveals the defect.

Again, a good workman with a spindle machine or novelty machine can give the bow stave a perfectly shaped belly in a few minutes; but the method cannot insure that the bow will be found equal at both ends—that has to be found in the growth, and accommodated by the skillful hand of the bowyer.

So far, the best that can be accomplished with the aid of machinery is to simply rough out the bow, and even this can only be done by an expert, qualified to do the thinking for the machine. As to the matter of time lost by the hand method, this after all can hardly be serious. In the presence of Mr. Arthur Knight, president of the Archers' Association in 1925, and of the young champion Lagai, the writer took a rough stave and with his hatchet and a few planes made a bow ready for finishing in some twenty minutes by the watch. I have yet to see machines do much better in time. And we have yet to consider the cost of the machines, and that of maintaining and running them. This of course may be scoffed at by manufacturers of archery goods. But I would not be a Scot born, and son of a long line of that race, were I to allow a dislike for treading on someone's toes to prevent my presenting the facts as I see them. It is my desire to keep all my many friends; but in this work I must hew to the line and let the chips fall where they may, the one purpose being service to the archers.

And so I will go further, and say that, in my opinion, nearly all of the innovations that come along almost daily now in the making of archery goods are innovations in name only, as I have yet to see anything new of a worthwhile nature. Each "new" idea that springs up has been tried many years ago and finally discarded. The multitude of so-called improvements that have appeared of late have all been precisely what I mean when I say foolish. Still, I must not bring upon my own head the accusation of being the same, by in any manner attempting to discourage the man who has the inventive bee in his bonnet.

As the present chapter is only introductory to my subject, I must not get into a vein leading into detail. So, if the reader feels impatient concerning something I have touched upon rather sketchily, I ask that he bear with me a little; doubtless the information will be supplied further along. However, in this connection, let me add that I fully expect that I shall be called upon to write many a letter in elaboration of this book. A pleasant enough penalty for me and decidedly easier than writing the book; but nevertheless not consciously invited by any little white sins of omission.

I have to expect, of course, that some of the writers on archery will not agree with me on various points. As for this, I may as well admit, as I have been doing my best to make clear, that I don't agree with everybody, either.

And this leads me to add a word or two along the previous line. We find some of the newcomers in the field copying the old style of Indian bows. Some of these are four times as wide as they are in depth. Naturally, a hint of the buffalo hunter's bow, or the warrior's bow, gets considerable wide-eyed attention from archers not giving the subject any real study. But who, the makers included, ever has asked himself the simple question why the Indian used a short, wide bow? Wasn't it merely because the short bow was handier to use on a horse, handier to carry and shoot in the thick of the virgin forests, than a longer bow? And because the extra width was needed to make up for the sacrificed length and depth?

The Indians of this country certainly were good bow makers and archers. But it is a singular fact that no archer of standing has ever yet reported coming across a remarkable bow of savage make anywhere in the wide world, not excluding the British Museum itself.

Again, we have the whaleback bow, stacked in the belly to nearly the shape of a cone. Why such a bow? I'm sure I don't know.

It is only natural that, in these days, when seemingly by the very nature of things in general almost every archer is an experimenter, all possible kinds of bows should be tried out. I make no objection; for why should I? But I do maintain the right to point out that, for all the fashions that have come and gone, bow making has produced but one best bow, and this, the standard type, is the only one deserving of serious consideration by the general run of archers.

The only actual improvements in the long bow of the old times of before the advent of firearms have been two. These are the dip and the take-apart splice.

John Buchanan, of England, was responsible for the introduction of the dip. Experience long ago taught that a perfect taper in the bow directly from the handle produced an inferior weapon. Yet we see them today. In devising the dip, Buchanan perhaps was concerned in getting rid of the whip class of bow, which archers seemed to hate to use, because of the disagreeable kick. His dip, placed in the belly at either side of the handle (see Chapter IV on Bow Making) produced a new class which became known as hard-handled bows. The dips, one in each limb, allow the bend to be distributed throughout the bow without actually bending the handle. And they usually produce a generally sweeter bow. For which reason the use of the dip will be found recommended in the instructions for making a bow, in Chapter IV.

Philip Highfield, also of England, I am led to believe was the originator of the take-apart splice. His portable bow, made in two parts and readily taken apart for convenience in traveling, apparently was popular for a time. But it fell into disuse many years ago. Makers and archers alike—and I believe this included even Ford—arrived at the conclusion that the principle was all wrong. They said it forced the bowyer to make a bow to suit the handle, instead of the reverse, as always had been done. However, I have made a careful study of bows made by Shepherdson, and I am forced to admit that, while there is much in this idea, on the other hand there is not a reason on earth why these bows should not be as successful as the bow in one length.

The principal objection to the common or one-length bow in this country is its inconvenience in traveling. And while the individual archer may get along at home, taking his 6-foot bow about in street-cars, motor buses, and even in his closed automobile, it is a different matter at a tournament. It is anything but a pleasure these days to tackle the transportation problem at a well-attended archery meeting. Where many archers together must squeeze into buses or street-cars already packed, each of them burdened with his lengthy package, the virtue of the take-apart bow stands out in sharp relief. And no matter what the experts, past and present, have against the take-apart bow, we are getting just as good results from jointed bows as from self bows, or the one-length variety. Still further, the take-apart bow has all the best of it when the archer has the misfortune of a break; it being such a simple matter to put in a new limb.

CHAPTER II

BOW WOODS

FIRST of all, let me point out that the opinions expressed in this book are often given without any references being made to contrary opinions which others have written or may hold. Therefore, as what I say on bow woods sometimes does not square with accepted opinion, the reader is warned to draw his own conclusion. Let him weigh any such seeming discrepancies in his own mind. Then if he is still reluctant to accept my word, perhaps he may be interested enough nevertheless to reserve his decision until able to prove to his satisfaction which is right, hearsay opinion or the old bow maker.

So now as to bow woods. To begin with, it would be a sacrilege, almost, not to say that yew is the king of all bow woods. Certainly there is no equal for real Spanish or Italian yew, the former easily taking first place, with the Italian wood close behind. The reasons are simple. They are the least liable to be affected by change in temperature, they always keep their shape, and there is no other known bow wood that can equal them in cast. However, sad to relate, they cannot be obtained—today they are worth their weight in gold. Neither Spain nor Italy will allow the little yew still growing within its borders to be cut down and exported.

Many will think next of English yew, for it certainly has a great reputation; a reputation founded, however, upon misconception and ignorance. So many writers tell about the famed English yew bow, that the average archer forms the conclusion that the greatest prize an archer can possess is a bow from that particular growth. The English archers made the yew bow famous, there is no doubt of that; but even as does the English bowyer today, they sought elsewhere for their yew. Just stop and consider the entire length and breadth of Great Britain—and that, of course, gives the English additional territory to come and go on; consider also the length of time it takes to grow a yew tree of fair size; finally, think of the multitude of English archers that came and went throughout the long period of archery's rise and decline in the "Tight Little Isle." Common sense must indicate that there is something wrong with the expression "English yew." The English archers did use yew bows, but few made from native growth, the large bulk being made from yew imported from Spain and Italy and quite a lot from the south of France. There is yew in abundance in Great Britain today, but the growth is coarse and mostly unsuited for bow making; so as of yore the English maker seeks elsewhere for his yew. For aught I know, he may even use some American yew—which supposedly when shaped in England becomes English yew! And at that, doubtless better yew than most of that ever grown in England.

American yew grown in the western mountains is the nearest approach to good or fairly good yew. In appearance it looks somewhat like that grown in the Caucasus Mountains, but in fact is somewhat superior, and can be distinguished by its richer color, the Caucasian yew being rather paler and lighter in weight.

Lately I have been experimenting with American yew. I am still uncertain whether the drawbacks that appear—principally the following of the string, or taking a set in the drawing direction—is due to the wood itself or to lack of experience on the part of those handling it. To make sure, the wood must be dried under my own observation. What I have on hand at present is being put through the right process of treatment, and only time can tell what the result will be. This treatment, I may add, is in direct opposition to that so often suggested to save time: washing the wood in running water.

Every expert bowyer knows from experience that the principal life of a bow wood, namely the resinous substance found in all sap, is cleaned out along with whatever it may be desired to remove by washing, and so the wood is ruined as a real bow wood. Proper storage, time and careful watching—these constitute the proper treatment for the removal of all moisture. The resin is left to harden in the wood and give life when at last it is needed. But I am of the opinion that the time required in this country is not that which is accepted as right in Great Britain. The difference in the climates of the two countries must be considered. I believe that the seven years required to season a piece of yew in Great Britain is much more than is necessary where I live, in the State of New Jersey. Here, four years should be ample, provided the wood is kept free from dampness.

Just here perhaps I may be permitted to

point out a policy in the treatment of bow woods. We all are familiar with the old rule, which originated goodness knows where, that the wood should be kept on its end or hung up by one end, to prevent it from taking a set. It must be obvious to any thinker that any billet of wood that will take a set from lying on its side—a set simply from its own weight—will be of little use for a bow.

Another such theory, very widely believed in but having no sound basis or justification, is that bow wood is best cut in the winter when the sap is in the ground. Just what is meant by the sap I am at a loss to understand; perhaps someone experienced with the sugar maple could explain. But at any rate, a woodworker learns to know sap of a different kind than that which goes down into the roots, supposedly, in the winter. Take a piece of timber cut in midwinter and another piece cut in midsummer; place an end of each in a hot fire, and watch the other ends. In a few minutes you will see the real sap begin to exude from the ends that are not burnt—and as much will come from the stick cut in the winter as from that cut in the summer.

To my way of thinking, the best that can be said of this popular notion is that it makes good advertising material. John Buchanan cut his great stock in the middle of the summer, and I have yet to learn of finer bows than his ever having been produced. I myself have cut yew in both seasons of the year, with as good results in the one case as in the other.

Of course, wood-cutting in the winter months as a general practice is very simply explained. First of all, the wood-cutters are very largely tillers of the soil, and in the wintertime can do no work in the fields. For another thing, where logging is concerned, wherever there is snow it is easier to get the logs out on the snow; furthermore, where streams are used to float the logs millward, utilizing the spring freshets is an important consideration. I do not here imply wood for bows; still, others try to use wood so obtained.

The bow makers of the past cut their yew wood in the same manner as they would have cut any other kind of timber. In early times, quite naturally they used to split the logs into billets, just as the American pioneers split logs into rails for fences. I dare say this is the real foundation for another groundless supposition, which is that yew should be split. Although we are told this, no one tells us why. I have no knowledge of any of the old bow makers of comparatively recent times splitting their yew logs, although much has been written about this being done. From the time they could get saws to do the work, these were used. Even when the billet is split out of the log, the best maker can do no more than follow the grain. A good sawyer can rip a yew log in a little time and make a cleaner job of it, with less waste, than any axman with his ax, wedges and maul. And if the billet turns out to be a cross-grained one it will be cross-grained whether sawed or split.

While I am about it, I may as well mention still another false supposition, this being that of the scarcity of yew. This is pure fiction. One can secure it from the West Coast by the carload. At any rate, I have had an offer of such a load—an amount of yew such as I could never use or even sell during my life.

A great deal of fuss is made over these matters, perhaps to cloak bow making with mystery, making it almost a lost art to the minds of credulous persons interested in archery. So far as I have ever been able to learn, there never in times past was any great secret about the proper cutting of bow wood—although we now hear it spoken of in whispers, as though the great secrets of the past were known at last and must be carefully guarded. And the same applies to the subject of drying. A great ado is made about this. But the renowned bow makers of the past attended to it simply enough. A good airy and dry place was provided where the wood was stacked up and left for several years, each billet being turned over at least twice a year. That was all there was to it—and is all there is today. Surely, nothing either wonderful or mysterious.

Still, those who would make profits from popular interests are ever ready and persistent. And in these days, with archery enjoying a new lease of life, we have our daily circulars telling of new discoveries in bow woods in every corner of the globe. These circulars praise their special woods to the skies, leading the unwary to believe that to become a champion involves little more than having a bow made from one or the other of these supposedly new bow woods. Let me say here in all charity and with due respect for the energetic pursuit of business which characterizes these importers of fancy woods, that they really have nothing at all new to offer. Having been continually occupied at making bows ever since 1892, and in that time having the choice of woods from almost every country on earth, I should be fairly able to recognize anything constituting a new discovery. And I must say that I fail to see in the "new woods" anything other than old friends with at times new names. Certainly all of the latest new offerings that have come as samples have been tried long years ago and found wanting; otherwise they would be well known through being in general use.

Having accorded yew its rightful place at the head of the list of bow woods, I have not by any means intended to imply that to have a good bow you must choose yew. Lemonwood must be given a place close alongside yew. The name, however, must not be confused with the tree upon which the lemon grows. They have no relationship, and the name of the bow wood is derived only from its natural color.

Nor is lemonwood to be confused with lancewood. The fact that extra good lancewood has been palmed off as lemonwood should not be permitted to weigh against the good name of genuine lemonwood.

There are really many advantages to be found in lemonwood that yew does not possess. The principal one is that of lower cost, a good lemonwood bow being obtainable at less than half the price of the royal yew. Shooting experts have proved that as good results can be had with one wood as with the other; and that on days when the temperature is hovering on the border of the unbearable (decidedly warm), the lemonwood will be found to stand up better than the yew. The latter wood loses weight much faster than lemonwood does as the thermometer ascends. This loss of weight, of course, forces the archer to keep continually changing his point of aim. The necessity of these changes is sometimes exasperating in the suddenness of the demand.

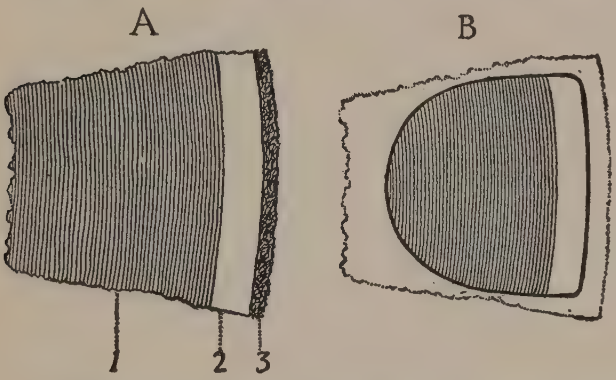
For another thing—and this is an important factor in the cost—with yew the wood must be cut from the outside of the log in order to utilize the sapwood, without which yew bows will not stand. With lemonwood, the bow stave may be cut from any part of any billet or log with equal assurance and satisfaction—provided, of course, the wood is not wind twisted, a growth which appears at times and is to be carefully avoided. Wind twisted lemon-wood has all the appearance of a beautiful growth of figured birch, so much desired for making furniture. To the experienced bow maker, these handsome markings mean that the grain of the wood spirals around the tree in corkscrew fashion—if we know what that tool is today. Lancewood also is subject to this defect.

To refer back to the sapwood yew, I am reminded that some explanation is necessary. Invariably, when a beginner comes to my shop he marvels at this feature of yew, that it has a sort of rind next the bark. This growth is readily seen, being always of lighter color than the rest of the yew stave. It is comparatively thin, there never being sufficient thickness to make the bow entirely of it. It has more tensile strength than the rest of the wood, in this resembling the rind of bamboo, which is used exclusively for making split-bamboo fishing rods. Naturally, anyone can tell a yew bow, from the two shades of wood.

The sapwood always is made the back of the yew bow, which is the outside surface when the bow is bent, the belly being the surface toward the bowstring.

As we get our American yew from the woodsmen who cut it especially for bow making, the best comes in part-round slabs, in length 4 feet 6 inches to 5 feet. Once in a while we manage to get a 6-foot piece, but they are rare. Some of it comes square, but this usually is not so good. The part-round billets are a half or a third section of the butt log, split or sawed vertically, and relatively shallow, the core of the log having no value to us.

The short lengths are largely due to the fact that yew that is clear of knots and young enough for bow making is not to be had longer.



A shows billet ready for cutting down to bow form. 1 shows heart-wood, the source of power. 2 shows sap-wood, the bow's protection against breakage. 3 is the bark.

B is a cross-section (at about the handle) after cutting down, leaving sap-wood about ¼ inch thick at center, and heart-wood more or less thick according to power desired.

The best timber for the bowyer is that of a tree of from 6 inches to 8 inches in diameter. This, by the way, is as true of Osage orange, ironwood or other native woods as it is of yew. In trees of larger growth the fibers are coarser. Young trees, like young people, are more supple than their elders.

Lemonwood is not a domestic growth. To the best of my knowledge, the best of it comes from Cuba and South Africa; the latter a source of many famous hardwoods long used by the bowyer. The real name of lemonwood is degame; although we commonly see both in the same list. Makers of fishing rods have long used it, especially for rods for salt-water fishing. They usually call these rods lancewood, but not always, and the wood easily leads all others for the purpose. As the tip section of many salt-water rods has to be 6 feet or more in length, the beginner at bow making should have no difficulty in procuring a suitable stave of lemonwood—though he doubtless will have to buy it as degame. It will be well to pay any difference requested for a selected piece. If this is possible, the first choice will be determined by a deep, rich orange color and fairly pronounced heft. Light-weight staves of pale yellow are not quite so desirable.

The genuine lancewood, the old growth formerly so commonly in use in Great Britain, where I knew it so well, was a native of the Guianas. I say *was* because I cannot obtain it now at any cost. At the least, there must be a scarcity of it. But where a really good piece of it can be obtained, it will be found to make a fairly good bow. For target work, not quite up to yew or lemonwood of equal selection, being somewhat hard on the hand; but still a good weapon. For flight shooting, it will easily excel any yew or lemonwood bow ever produced. It has a cast that is almost perfection, as far as bows may be claimed to be perfect.

This good Guiana lancewood is often mistaken for lemonwood by its appearance. However, it is a buff color, not orange or yellow, and has a distinctive marking which is called shot. It has a similar appearance to maple or beech, with their many little ticks, but cannot be mistaken for either of these woods. It is very heavy; but this does not injure it for bow making, as a bow of this wood will require but about two-thirds the amount needed to make any other class of bow—except, of course, where using any of the real hardwoods.

Lancewood in general, however, is of so many varieties that it is never considered a safe wood for the bowyer to use. Even the most expert in the handling of it can be fooled at times, and have a lot of trouble for his efforts to produce a lancewood bow. The wood is plentiful, and can be had at very little cost from almost any dealer in fancy hardwoods. But in

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most cases it will be found to be of the black variety and as brittle as glass.

In England long before the coming of the automobile, carriages and the better grade of carts and one-horse wagons one and all had their shafts made of degame, or lancewood, one or the other. And the bowyer had no trouble in securing all the bow wood he wanted, at small cost, from the carriage makers. The shafts were cut from the whole log in the shape desired—and some of them were certainly shapely! So there was a deal of waste, and the cuttings were almost given away to the makers of bows and arrows. Many a splendid bow stave did not cost more than five cents!

From this "broke," as it was called, reputable archery-goods houses carefully selected and graded what was used. Toward the end, it was seen that lancewood was undergoing a change. Upon inquiry they were informed that owing to the scarcity of lancewood a substitute had been found in degame, a wood hitherto unknown to the bow maker. As the "broke" consisted of pieces left over from both lancewood and degame, the bowyer had to be careful in choosing one from the other, and named degame, lemonwood owing to its color. At first all lemonwood bows were stained a deep brown with a coating of nitric acid. This was the origin of lemonwood.

Many of the virtues of yew might also be claimed for Osage orange. Their principal difference is that yew is classed as one of the softest hardwoods, while Osage orange is a real hardwood in every respect. Staves of straight growth of the latter wood are almost as difficult to obtain as in the case of yew. Also, here again as in yew the majority of bows just join in the handle, a 6-foot stave being the exception rather than the rule.

Osage orange is a real bow wood. Generally speaking, if well chosen and properly seasoned it will outlast any other kind of wood for this purpose. The Osage orange bow, however, is usually a hard master. Only the archer who can claim the best of physical prowess can ever hope to get the best out of one of them. The cast is not quite equal to that in the other bow woods that have been discussed. Still, it makes a real good bow, and there appears to be a good deal of it, growing generally over the country. This comparative abundance, unfortunately, does not make good selected and properly seasoned staves of it at all common. Aside from its interest as a bow wood it almost never finds its way into a lumber yard.

The same directions for making a yew bow apply with this wood. The sapwood, or back, is not quite so noticeable. However, even a stave from which this is absent can be used. The wood does not appear to actually need the backing, in this respect being like lemonwood and lancewood. They do not possess the sapwood in visible form, and seem to serve thoroughly well even when the stave, carelessly or otherwise, has neglected to come from the proper place, a next-to-the-bark position in the log.

CHAPTER III

BOW WOODS—*Concluded*

IN the previous chapter I mentioned some common domestic woods properly supposed suitable for bow making. It is far from pleasant to be compelled to dispel a popular illusion of long standing, of the worth of such woods. I know from much experience how good people, especially boys, are disappointed to learn that such an idol among the woods as hickory is has really no value as a bow wood.

In addition to the yew of the West Coast and Osage orange, live oak and ironwood are the only other domestic bow woods that can be properly classed as such. The latter, though abundant, has the drawback of being very hard to work. Further, it has little in the way of cast to recommend it, as compared with the bow woods previously discussed. It will, however, make a fairly good bow, provided the shape is made rather flat and shallow. A wide bow of ironwood with little depth may with perfect safety be made much shorter than common. These, by the way, are the best woods for the Boy Scout to use in his bow making. But he must make sure his stave is not cut from a log that has been floated down some stream to the mill, for that will have washed the sap out of it. This also applies to other common woods purveyed by the lumber yards.

Ash is much praised by some manufacturers of archery goods. It will shoot—in a soft and unsatisfactory manner—as long as it remains green as will various oaks, elms and others. But just as soon as any of these, including ash, is dried out, in nearly every case it will break. *They are not bow woods.*

Hickory might well be claimed to be the best of the common woods for simple bow making. It is easily the toughest, and even when dried out it will stand a lot of hard use. But unfortunately, cast is not in the wood; hickory is not a spring wood. And again I repeat that cast is the first essential for a good bow.

Many of the modern writers have named long lists of bow woods from which the boy archer may take his choice. Besides those just mentioned, these include cedar, beech, hickory, locust and others. The only reason I can ascribe for such long lists is that probably these writers expect that the Boy Scouts among their readers may be either impelled or called upon to go out in the woods and chop down their own trees from which to make their bows. Thus perhaps they consider a number of different trees to choose among may be handy for the Scouts. I need hardly point out that the idea of cutting down trees is already entirely too prevalent for the good of the country's forests. Trees of suitable size for yielding bow staves should not be cut for that purpose alone; except yew or Osage orange, and they only by competent woodsmen, able to select the right ones. As for boys cutting these latter two, they still would have to wait four years for the wood to dry properly, when they would be boys no longer.

For another thing, such haphazard instructions do not inform the boy that a bow stave should come from the outer surface of a tree not less than 6 inches in diameter nor more than 8 inches. Usually, what the boys do is to cut saplings a couple of inches through and use the wood without drying. Naturally, they get but very poor results, the green wood having little cast in it; and as their bows dry out the breakage completely offsets any success obtained. The lad who perseveres under such handicap and becomes an archer is the exception rather than the rule.

It is a waste of time to bother with any of the multitude of bow woods, mostly hardwoods, imported from various "new countries" and represented as being superior to yew and lemonwood. While they make fairly good bows as far as durability and cast are concerned, they all kick like a mule and most of them require backing for safety. (See the chapter on bow making for the real purpose of backing.) Some of these woods are washaba, partridge, zericote, tambouka, snakewood and fustic. Many years ago, at a forestry exhibition in Scotland all the choice woods of Africa, the land of hardwood for bows, were on display. After the exhibition closed the bow woods were turned over to Peter Muir, who experimented with all of them but found nothing to warrant adoption. Such as were taken up for a time years ago have long since been discarded by the regular bow makers.

That some bow woods are more susceptible to changes of temperature than others has long been recognized. It is doubtful, however, if many archers have as yet been able to ascribe a satisfactory reason for this anything but pleasing phenomenon. At a tournament, at the beginning of a match, the bow is evidently everything desired but as the day advances the thermometer climbs to a point verging on excessive, and then the archer is heard to exclaim that his bow is going down. He means that it is losing weight or power—becoming weak. The generally accepted theory is that the bow becomes tired after so much effort in the heat, something which does not occur in shooting on much cooler days. But I believe this theory to be wide of the mark.

I am not an authority and do not purpose to give an indisputable reason for the weakening of the bow under the conditions described. But I am able to tell the combined opinion of such old-time authorities as Muir, Buchanan, Aldred, Fergie and others. A conclusion arrived at after much talk together and probably some experimenting. As I have previously pointed out, the sap is not simply moisture found in even the driest of woods, but is fully as much the resinous substance which is the real life of the wood. This resin is more abundant in some woods than in others. Yew, belonging to the pine family, has more than a liberal supply in its composition; lemonwood (degame) is almost devoid of resin. In the opinion of my chosen authorities, the resin is affected by heat and cold as all gummy substances are. Hardening from cold, it gives most cast to the bow;

softening from heat, it subtracts cast. This may not be the real answer, but it is borne out by the fact that yew is subject to considerable change in cast according to changes in temperature, whereas lemonwood is affected but little. And I think we all feel that the idea of the bow being tired does not quite satisfy.

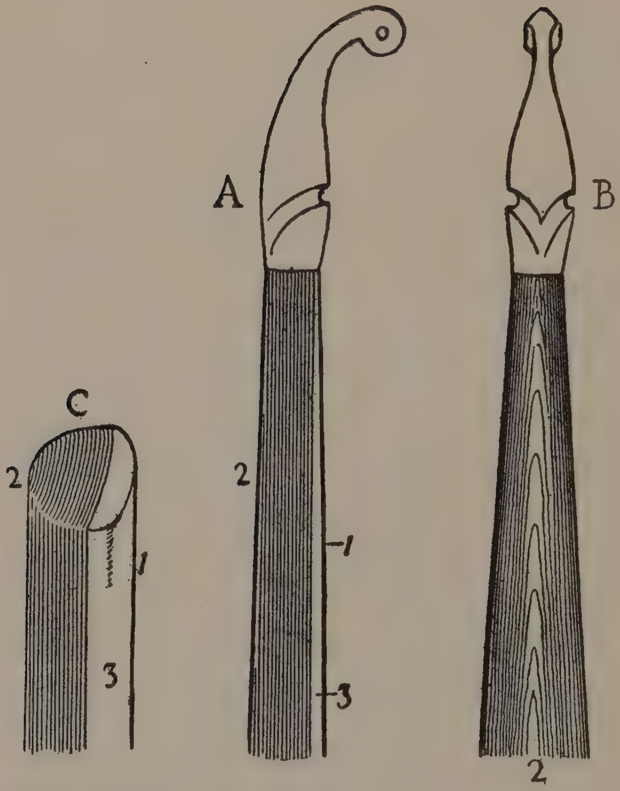
To the average archer, it will be enough to obtain the opinion of men of long experience, as above. He is content to pick up a smattering of such information—the little details which are supposed to be kept secret from the man who does not make a business of archery. But the investigator, perhaps, may not take it amiss if I suggest giving careful study to the science of osmose, and particularly to the viscid fluids to be found in more or less degree in the various kinds of bow wood. This is a special subject for a scientific treatise and not for dabbling with in a book of this kind. It is worthy of mention, however, that the student of archery who has the capacity and the opportunity to master an understanding of the cell life of plants and to acquire a fair scientific knowledge of the growth, structure and chemistry of woods, will have a great advantage over the average archer in understanding and using bow woods.

CHAPTER IV

MAKING THE BOW

First of all, let me recommend the beginner if possible to have at hand a professionally made bow for a model to refer to. It will be found very useful during the making of the first bow attempted.

Next, I must emphasize the fact that every stick of bow wood is a law in itself, and that no absolute rule can be laid down for bow making. There can be no fixed standard that will apply to shaping every piece of bow wood into a bow. It is true, there are writers who tell us in set terms just how to take any piece of wood and shape it into a bow. However, these authorities neglect to tell of the number of staves destroyed in the process of producing the weapon they write about. These writers, being amateur bow makers, perhaps can afford such waste of material and time. But the professional, with a living to make and a reputation at stake, must watch his step, as the saying goes, and accordingly he works differently. He does only what he thinks to be absolutely sure of success, being of necessity very jealous of his



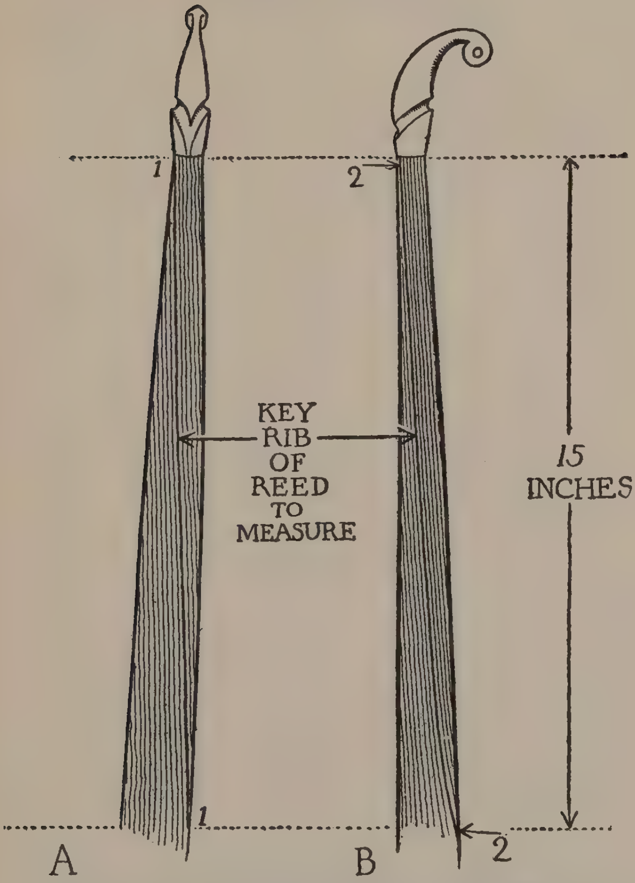
A. Side view, shows "reed" of grain running down side of bow.
B. Front view, shows rift or chamfer.
C. Cross-section seen from side, showing annular rings, and perpendicular grain or reed.
  1. Back of bow.
  2. Belly of bow.
  3. Sapwood backing.

time and materials. He uses only woods that he can rely upon, for it is up to him as a reputable maker with faith in his own work to guarantee every bow he makes. In the light of this situation, it logically follows that the methods of the practical professional bow maker must command the most respectful attention, to say the least.

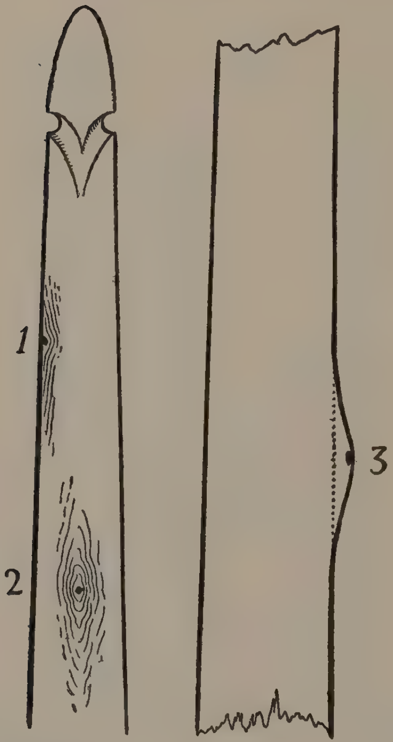
The average bow demands material in the rough having the following dimensions: at least 1⅛ inches square by 6 feet in length. This is for the average man's bow; for the average woman's bow, the diameter should be ⅛ inch less, and the length at least 5 feet 3 inches. But let me reiterate that there is no absolute rule, as bow woods vary so much.

Perhaps it is well to elaborate this before going on. Some writers lay down the rule that the proper length of the bow is the height of the shooter himself. Perhaps the rule does apply in a general way; but by no means is it a good rule to follow hard and fast. The reason it is not is very simple. We have men and women archers who cannot claim to be tall, yet who have an arm reach exceeding that of archers of noticeable altitude. Actually, the length of the bow should be governed by the length of the arm of the shooter in drawing his arrow to its head—a rule the professional maker always has recognized. And accepting the standard set by the professional makers of the past for the majority of archers rather than for the few, we set the length for a bow for a man at 6 feet, that for a woman's bow at 5 feet 6 inches. Now for the reason: these lengths are considered safe for the draw of the arrows used, which thus may be said to indirectly set the standards. It is true that bows of shorter lengths often will stand the standard draw; but no professional maker will ever guarantee a bow that is made under standard lengths. In the bow maker's shop, withal great care has been given to selection of bow wood staves before laying them away to dry, when at last one of these is taken up for shaping into a bow it must be scrutinized to make sure as possible that the grain is as straight as may be. At the worst the grain of the wood should not cross the bow in less than 15 inches, and this minimum allowance must not apply in all cases. For instance, the grain should not cross the bow from side to side in so short a length as 15 inches; but a good bow may result from a stave having the grain crossing at this length from back to belly.

Knots, of course, in general are to be consid-



From back to front, or reverse, take a single reed or fiber of the grain, follow it from one side of bow to other. If shorter than 15 inches risk of break attends its use. 1 to 1, grain running from side to side. 2 to 2, grain running from front to back.



1. A side-exit pin.
2. A center-exit pin.
3. Right method of "raising" a pin, or leaving an extra amount of wood around the spot; not cutting down to true line of bow, as indicated by dotted line at 3.

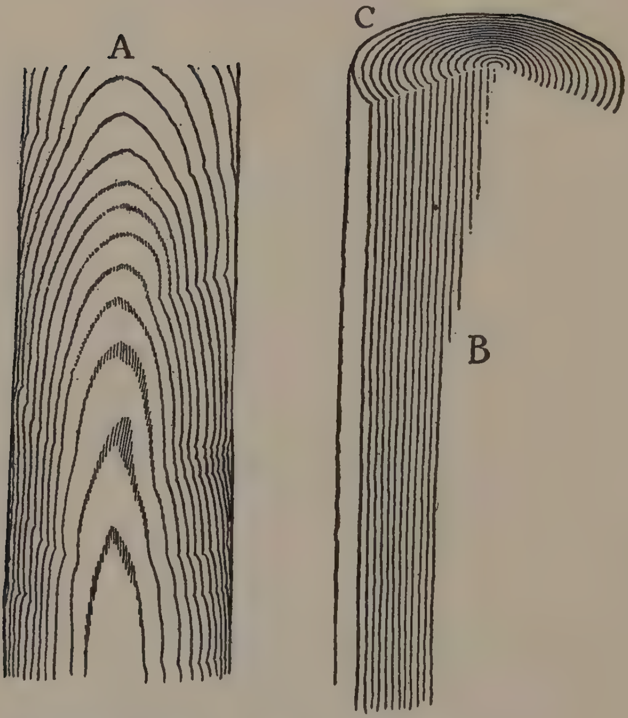
ered a detriment; but a stave need not be discarded because of there being a little pin or two in it. The most damning of these knots or pins are those which are found running right through the center of a limb. A pin is never considered a serious detriment where it runs on the outside of the bow, as it affects the bow but little. Of course, the professional maker is never supposed to take chances with these pins, and in order to guard against possible weakness he "raises" the wood at the pin, leaving a little mound around the pin—a trick of the trade affording more protection to the archer than may appear possible.

In the softest of hardwood used for the bow, the sapwood must be left on the outer side, and this is to become the back or flat side of the bow, for protection against breakage. In other woods, where the sapwood is not *apparent,* an expedient sometimes used is to supply a substitute backing, in the form of some real tough wood such as hickory. These are the bows that are backed, and this explains why there are such bows. The idea that a backed bow has some advantage in strength and cast that is not possessed by unbacked bows is erroneous.

We have been discussing the making of the bow as done by the professional bowyer; but it is well at this point to look at the subject from the viewpoint of the amateur, for just a moment. A great advantage to any maker in using lemonwood or one of the inferior woods represented as bow woods, among them ironwood, ash, elm and oak, is the fact that these woods can be obtained in ample length for making self bows; that is, bows made all in one piece. This saves time, and for the novice the somewhat difficult task of jointing the bow in the handle. As a general rule, yew and Osage orange have to be jointed, it being rather difficult to obtain these woods in sufficient length to make bows in one entire piece. Although, paradoxically, it is quite a common thing for a professional maker to deliberately cut yew staves of sufficient length for self bows in order to get a perfect match of wood for both limbs of the bow desired. Where the two limbs are taken from one stave in this manner, having grown side by side they make as near to a perfect match as it is possible to secure.

Though it may seem a discouraging delay of discussion of the actual process of making the bow, it is well to divert again to the subject of the grain of the wood. This because I have long known, from a heavy correspondence with archers, that there is general misunderstanding concerning grain. For example, books on archery inform the beginner in bow making or in selecting archery equipment, that the grain of the wood should run down the sides of the bow, not down the back or the belly. Also, that the grain of the arrow should be on the side that runs alongside the bow in shooting. With this information before him but no actual knowledge to work on, the amateur bow maker, evidently with thoughts of the handsome "graining" of quartered oak furniture, or the imitation cleverly painted on a door panel, proceeds to lay out his bow exactly wrong. What he thinks to be the grain is not the grain at all, but that feature of the wood which is known to skilled woodworkers, or anyhow to professional bowyers, as the rift, feather or chamfer. There doubtless are other terms used, according to locality; but in any case they refer to the *flat* of the grain.

To speak of the grain of a piece of wood is to refer to the surface appearance from an exact right-angle view of the run of the fibres. This will be readily understood when it is explained that the fibres naturally run vertically with the growth of the tree and the point of view is horizontal. For another explanation, in a log sawed lengthwise, *through its* center, the surface of the lengthwise cut will show the grain and when a horizontal cut is made the surface of that cut will show the annular or year rings by which we ascertain the age of a



A. Chamber; feather; or rift.
B. Grain; or reed.
C. Annular rings.

tree upon cutting it down. I believe the simplest explanation is to say the grain is the vertical of the annular rings seen at a right angle. (See diagram.)

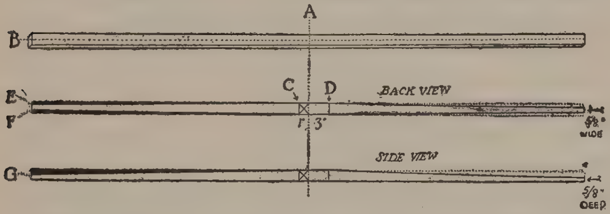
Having clearly in mind the proper surfaces of the bow stave to be chosen for the sides of the bow, it will be understood that the surface forming the back and that forming the belly, being at right angles with the bow's sides must show the *flat* of the grain, previously referred to as the rift, feather or chamfer. For our purpose we will call it the rift, as this is the expression most used.

Having arrived at a clear understanding of what constitutes grain and what the rift, the beginner will more thoroughly understand the reason for the rule previously given that the grain should not cross the bow under 15 inches. It is easy to make this measurement, by following any individual line of the grain, from where it appears as a rift mark across the belly, to where it appears as a rift mark across the back.

And now assuming a satisfactory bow stave has been selected, the amateur will require a template or pattern for use in laying out the bow on the bow stave. An expert bowyer with a good eye for the work can dispense with this pattern; but nevertheless few of even the best makers will be found doing so. Make this template of any soft wood, preferably 1 x 2 inch, straight and smoothly planed. On this strip of pattern wood, first draw a center line 6 feet 2 inches long. With this line to work from, proceed as follows, referring to the accompanying illustration for guidance: first lay out the handle. Make a mark exactly midway the center line. From this midway mark, place a mark on the center line 1 inch toward one end of the template being laid out; from the midway mark, measure 3 inches toward the other end and place a mark. This provides 4 inches for the handle. Now measure out at each side from the center line at these guide marks for the handle and make four corner marks, each 9/16 of an inch at a right angle to one side and the other of the handle marks already placed on the center line. Last, join these four corner marks by drawing straight lines. These lines will be two each of the same dimensions, the short ones crossing the center line being 1⅛ inches, the long ones 4 inches. Thus when completed the diagram for the handle will be a rectangle, 1⅛ inches x 4 inches.

This detailed instruction for laying out the handle of the template is given for the reason that the handle provides the base from which to work, and its location is 1 inch off, or toward one end, of the exact middle.

Now to conclude: Next, measure out from these handle marks the necessary distance toward each end of the template to the point which is to be the end of the limb of the bow; these points being located by measuring an equal distance from the middle mark of the template, and *not* by measuring from the pattern lines of the handle. Thus it will be seen that one limb of the bow is to be shorter than the other. Having located these end marks on the center line, measure out at right angles to each of them and place a mark 5/16 of an inch on each side. The four marks thus made will be in two parts, each two marks being ⅝ of an inch apart, and the distance from one pair to the other being the length of the template or pattern for the bow. Now, last of all, take a straight-edge and draw four lines connecting these two pairs of end marks with the four corners of the rectangle forming the handle



Select stave 6 feet long by 1⅛ inches square. First, mark off dead center, A. Then from end to end draw a line through middle, B. One inch from center line, A, draw line across back at C. Three inches from A, draw another line across stave at D. This gives 4-inch area for handle, C upper, D lower. From C, draw two lines to end of arm E and F, each 5/16 inch from center line, B, and ⅝ inch from one to the other. Repeat from D to other end, and trim off bye-wood. Then from C at belly of stave, draw line on side of stave to G, ⅝ inch from back. Repeat from D to other end, and trim off bye-wood.

pattern, and conclude by drawing a ⅝ inch line at right angles connecting each pair of end marks. The template is now laid out, or completed. (See diagram.)

This template is to be the guide for laying out a bow on the bow stave, the markings on the latter being exactly the same as those on the template. To serve as a handy reference, the different dimensions may be written on the template.

Having laid the bow out and made sure the lines marked on the stave are correct, then proceed to cut away roughly the surplus wood of the stave. And for this work, no matter what many writers say to the contrary, use a sharp hand ax or hatchet. Simply stand the stave on end, hold it with one hand and chop with the other, if you are right-handed operating on the right side of the lower limb, the marking on the stave toward you so you can watch closely every cut made by the ax. Reverse the stave to work on the other end; and of course chop literally all around, closely following the lines but never cutting into them. If the ax accomplishes this work without running into the stave deeply, then you have a fairly good start. This because the ax will surely discover any flaws, which may not have been visible. And if in the process the ax runs across the stave and spoils it, you are saved further work on a bow which would surely go bad at some later stage. On the other hand, as already intimated, if the ax does the work satisfactorily, the stave is thus proved reliable.

The depth of the bow stave in the rough, from front to back, will be 1⅛ inches. This is the standard used by all dealers in bow wood, and a beginner will have done well to have patronized one of them.

Having roughed out the bow by chopping down its sides to the guide lines in the manner described first, rough-shaping the back should follow. But first smooth down the sides with a plane so a guide line can be drawn on each of them. And in this smoothing, of course be careful not to work into the guide lines marked on the stave in the first place.

Now you must decide which side of the *flat* of the bow is to be the back, as this is to be the base to work from, the taper being cut away in the opposite flat, called the belly. If the wood is lemonwood or any other not having a visible growth of sapwood, the professional maker decides by examining the run of the grain. If it is yew, then the sapwood decides the point, as it must form the back. (More is to be said of sapwood, but this has been covered in the previous discussion of bow woods. Generally, we plane down the white sapwood of a yew bow so that a uniform thickness of ¼ inch is left at the sides.

To decide which flat of a lemonwood or an ironwood bow stave to make the back of the bow, must be left to the judgment of the maker. To here attempt to give instructions for deciding from the appearance of the grain, would lead into a long and intricate discussion, with small hope of attaining much success; this because, as previously remarked, each piece of bow wood is a separate law in itself, and there are no general rules to follow. If there were such rules, there would have been no need to use the hand ax in chopping the bow out of the stave. But the ax was the best rule we had to guard against wasting time on a stave with a flaw or two hidden in it. And by the same token, the ax will have thus also insured the amateur maker that he cannot go far wrong whichever flat of his stave he selects for the back.

Having chosen the back, plane down the edges ⅛ of an inch, a flat cut.

Now to shape the belly. First, take the straight-edge and draw guide lines for the belly as follows: at the points previously marked for the handle and ends of the bow, make a horizontal mark on each side, those at the handle the width of the stave, and at the ends extending ⅝ of an inch back at a right angle from the top surface of the back of the bow. To the ends of the two marks thus made at the bow's ends, draw a line on each side from the two inside (belly) corners of the handle as marked out. (See diagram.)

Next, with a spoke-shave or a plane roughly cut down the belly to these guide lines. Then your bow will have reached a square-edged shape approximating the tapers from the handle to ends that it must have when finished.

Working with the unfinished back of the bow stave as the base, the shaping of the belly is now to be undertaken. If the maker happens to know a wood-working shop, perhaps he will think well of taking his bow there to get it finished. If he does, the woodworker can quickly dress it down to the lines laid out. Then if there is a novelty, or spindle machine, this can be used to as quickly round out the belly to the pattern desired. After which, when the back is roughly rounded and shallow temporary notches have been cut at the extreme ends for the bowstring, the new bow may be strung.

However, I imagine that the average man or youth attempting the task will have no thought of bow making as a trade, and will be little interested in machine work. So we will proceed on the supposition that it is to be entirely a hand job.

I have previously spoken of using three tools —ax, plane and spoke-shave. Common sense will prevent any further use of the ax; but it is necessary to say a word of warning against the spoke-shave. This excellent tool like the draw-knife so commonly an accessory of the home work-bench, must not be used further. Because with it there is grave danger of cutting hollows, deeper than is intended. Actually, even for roughing out the bow to the shape now reached in this discussion, the best tool is a jack plane. One 3 inches wide by 15 inches long is about right to avoid side jumping and making hollows.

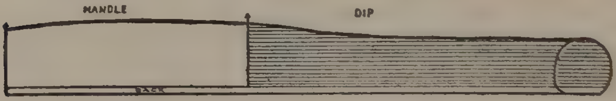
For roughly rounding off the belly, an ordinary hand plane should be used. In this work, fasten the stave down on the bench, and take the wood down from the handle to each end. Watch the dimensions closely, and do not take off too much wood in your hurry to get your bow strung up.

Remember, your stave was cut down "square" to 1⅛ inches wide, 1⅛ inches deep at the 4-inch grasp, or handle, then tapering to ⅝ of an inch by ⅝ of an inch at each end. *With the top surface of the back of the bow left untouched,* or in other words absolutely straight. Thus the taper of the *flat* of the bow was equal from each side of the center line that was laid out first of all. But with the back of the bow serving as the base for laying out the belly taper-marked on the *sides*—the angle is all on the belly side. The back remains straight as when the stave was still untouched. (See diagram.)

Keep firmly in mind that this is the correct *design* of the bow; for your pattern lines will disappear under your plane as you proceed with the rounding of the belly. *The depth of your bow must taper from* 1⅛ *inches* at the handle to ⅝ of an inch *at each end without taking any wood away from the wide crest of the original flat surface which you chose for the back.*

If you have not already learned it, from the diagrams or otherwise, let me say here that the *back* of a finished bow of the kind we are discussing (the English long bow) is the side held farthest from the archer in shooting. The *belly* is the side held toward him. And the *sides* of the bow parallel the arrow.

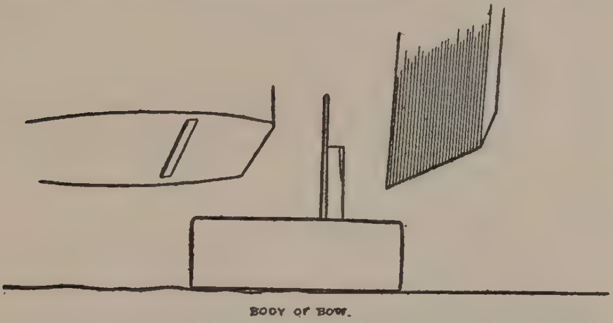
In shaping the belly, much importance attends cutting the *dips,* which begin at the grasp. These dips have a depth reaching ¼ of an inch below a straight line from the 1⅛-inch belly surface of the grasp to the ⅝ inch point at the tip of the bow's limb. Their length, to the ¼-inch point, or the center of the dip, is 5 to 6 inches, depending on the *weight,* or drawing strength, of the bow. (See diagram.) The dips should begin right at the handle, and rather quickly, their sweep being less abrupt as they return to the straight line of the taper from handle to limb tips. This line to be the ridge of the belly for most of its length, but an imaginary one above the dips.



The Dip starts right from the handle and is sudden and hollow rather than a gradual taper. To taper would result in a break in the bending and probably cause a fracture.

The round of the belly may be any desired, but it may be remarked that the bow will cast better for not being made too flat. Your jack plane will be the best for taking off the byewood. If you have a model bow to work from, make frequent use of a gauge in order to prevent taking off too much.

Last we come to the real fine work. It consists of getting the surfaces completely flat along the lines of the taper, and the tool to be used is a toothing plane. This, the most important instrument known to the trade of bow making, is provided with an upright cutting iron which prevents making anything but a perfectly even surface. Thus it takes off all invisible "hills" and erases all hollows. And it makes a very clean job out of even the coarsest of bow wood; for it does not cut, but rather scrapes.



How toothing plane takes down "humps" (which throw excess strain on weak spots), and leaves a true line, so that all parts of bow pull with evenly distributed power.

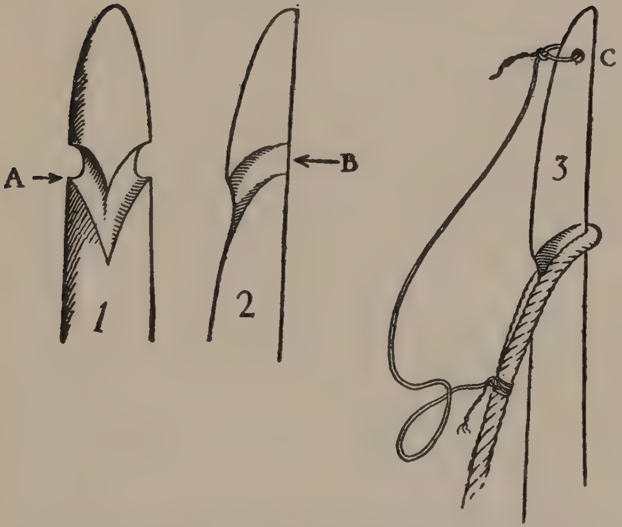
Good results can be had with a scraper plane, but the toothing plane has no equal for this kind of work.

As will have been borne in mind right along, the work of making a bow is really nothing more than a cutting-down process. And always the maker must keep some slack, so to speak, as he approaches the finishing. One can always take more wood off; but putting it back on is impossible. Do not forget this, for there is almost sure to be some work to do in adjusting the two limbs to pull just right.

The edges of the back may now be rounded off, and the temporary notches cut—as near the ends as possible—for the bowstring. The addition of the grasp may wait, as it usually will, until the maker has satisfied himself how the bow is going to behave.

The temporary nocks for the bowstring may be cut with any round file. I use a rat-tailed rasp, many of which I have imported especially for the work. They do it quicker and cleaner than it can be done otherwise; but so far I have never been able to find a hardware store in this country that has had such rasps. If the bow is to be equipped with horns—which are commonly used, but only ornamental and so not absolutely necessary—the temporary nocks for the string will subsequently be removed in shaping down the tips of the bow's limbs to receive the horns.

It is now time to string up the new bow. How to do this need not be told here, as the string



"Self nocks" are where horn tips are dispensed with and nocks are cut into the body of the bow-stave itself.

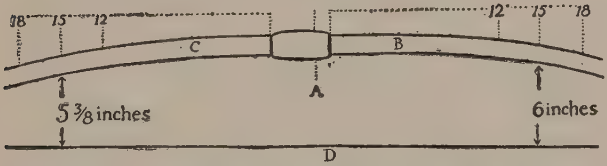
1. Belly view. Do not leave sharp edges at A which may cut bow-string.
2. Side view. Never cut into back of bow at B, leave back flush.
3. Side view, showing upper nock left longer, with hole drilled at C for small anchor cord to tie on bow-string and prevent its slipping down the stave.

and stringing must be covered at length later on. The reader is requested to refer to later chapters for this information—that on the bow-string, and that on shooting.

It is very important to prepare the bow for stringing, by occasionally bending it a little during the process of shaping it. This can be done easily and quickly, by handling it somewhat in the manner described in the directions for stringing, Chapter VI. This bending from time to time will show you how the bow tends to act. If one limb bends more than the other this will be discovered and counteracted before too late. For another thing, unless the bow is frequently bent before stringing, it may lose many pounds after being drawn up.

With the string on, first draw the bow carefully, a little at a time to break it in. Watch it closely, noting any unevenness in the bend.

It being remembered that the lower limb of the bow is shorter than the upper one, it should be somewhat stiffer. In the past the old-time makers gauged their correct relative resistance to draw in the following manner, which is still in use among professional bowyers. When a newly finished bow is strung, the maker first marks it out for checking the draw. Starting at the outer edge of the handle, he places a mark at 12 inches, 15 inches and 18 inches therefrom, on the belly of each limb. Then he measures the distance from the braced string to the ridge of the belly at each of these marks. The rule is that the lower limb should stand about 3/16 of an inch nearer the string at these points than the upper limb does. In other words, let us say that, if at the 15 inch mark of the upper limb the distance from the string to the apex of the round on the inside of the bow is exactly 6 inches, then the distance at the 15 inch point on the lower limb should be 3/16 of an inch less, or 5-13/16 inches.



Method of assuring extra strength in lower arm to "hold up" the arrow in its flight. A. Dead center of bow. B. Upper arm. C. Lower arm. D. String. (See explanatory text on page 58.)

Any spring scale of sufficient strength may be used to ascertain the exact weight, or drawing strength, of the bow. This can be reduced, if desired, by working the bow down thinner. But weight can not be increased in a finished bow, save by shortening; which, however, increases risk of a smash. It is well to allow 2 pounds in excess of the weight desired, as a little use of the bow will, in most cases, bring that much loss. The weight, of course, is that obtained at the full draw of the bow. This, as before remarked, is governed by the length of the arrow, beyond which the bow never should be drawn.

CHAPTER V

BOW MAKING—*Concluded*

THE standard length for arrows is 28 inches, regardless of the weight of the bow. And of course a full draw is usually taken, in order to obtain regularity of trajectory. Thus the length of the shot is regulated by the aim, not by the amount of draw. I am referring to target shooting; flight shooting and hunting are different matters.

To the beginner the weight to select for the bow is a matter of careful consideration. If the bow is to be used for practice at the American round, where 60 yards is the set limit a weight, or draw, or 45 pounds at the most may be said to be about the correct thing. If the York round, which takes in 100 yards as a part of the round, a bow of approximately 50 pounds draw will be required. The correct weight in arrows will be found in the chapter on arrow making.

It is easy to understand that a shooter should not attempt to use a bow of such weight, or power as will be found to be beyond his complete control. The old saying, "under rather than over the weight," which was applied to the selection of a bow centuries ago, is just as applicable today. But with arrows it is different, the weight of the latter being determined by the power of the bow and the purpose of the shooter.

After the beginner reads with envy of the wonderful shooting done by archers of the old school of fiction, and of some of the modern archers, whose records if less imposing are authentic, he aspires to do great things too. And reading that Mr. A. has a bow drawing 65 pounds with which he shot an arrow 280 yards, he likely enough decides to help out his inexperience by going in for abundant weight in his bow. For instance, he may infer that if a 65-pound bow can throw an arrow 280 yards, then by adding 25 per cent more drawing strength in his bow it should have the power to shoot 25 per cent farther, or an additional 70 yards. But this by no means works out. Because, after a certain weight has been reached any additional weight will act as a hindrance to casting power rather than a help.

There is a definite limit to the possible amount of cast in each individual stave, and beyond that limit the more weight added the less will be the cast. Then again, it must be remembered that in bending, the fibre of the wood will compress up to a certain degree but no more. Let me cite a case in point.

During the flight shooting at Rome, N. Y., in August, 1925, I was captain of the green. When Dr. Crouch stepped up to take his turn, I inquired the weight of his bow, which appeared very heavy. Upon being informed that it was over 90 pounds, I ordered the spectators to retire to a safe distance, explaining that a break might occur. And the bow did break, on the very first pull. Naturally, I was thought to be something of a pooh bah, as the saying goes. But it was not guesswork on my part; I had ample experience to guide my judgment.

On the other hand, a bow of 150 pounds draw, with the archer permitted to lie on his back and use both hands for the draw and loose, has only produced a flight of 311 yards. This is little better than the distance shot by the 55-pound bow used by Bryant in winning the flight at Jersey City, N. J., in 1926.

Many years ago, while in the employment of the Royal Company of Archers in Scotland, I made a bow for the late Dr. Jamieson, a well-known and fairly good archer of his day. As near as I can recollect, this bow weighed some 88 pounds, and was of course too heavy for anything but flight shooting, which it was intended for. But Dr. Jamieson never reached 270 yards with it, and gave up all thought of attempting a flight record. However, the wood was an ideal piece of selected yew, and so the Doctor had it reduced to a 54-pound target bow. And with this light weapon he some little time afterward succeeded in sending a flight arrow over 280 yards! Obviously, by reducing the weight the bow's cast was increased. And again I say that it is the cast that counts.

Perhaps the tyro will wish to be told just what cast is. I can do no better than quote the late Colonel Walrond, of the Toxopholite Society of London: "Cast is determined by the obvious trajectory of the arrow in flight. . . . Thus, an archer may take two bows of equal length and weight, and both of the same material, and shoot the same arrow from each, with the result that in the case of one bow the arrow flies as though rising scarcely about six feet from the ground, While with the other bow the same arrow describes a well-defined arc, rising a considerable height. This is due to the superior cast in the wood of the bow that throws the flat or low-flying arrow."

While on this subject, it is well to add a few words about backed bows and three-piece bows. From the abundant comment and praise that has been and continues to be published in behalf of these bows, nearly every one is familiar with the claim that they are backed and built reflex in order to assist the cast, always so much in demand. But it puzzles not a few archers that none of the writers who are so positive of the merits of such bows, ever goes to any pains to prove that bows so built actually have superior cast. Actually, if it were true that the backing and reflexing of the bow added to the cast would not some of such bows have been found to outshoot the self bows? Yet they are not on record.

Even when a backed bow is found that has a particularly fine cast, I imagine the real benefit will be in the original stave itself, not in the addition of the backing. Certainly there can be no assistance from the hickory, and that is the material most commonly used for backing. So we are compelled to infer that any aid received comes from the glue!

The maker who first introduced the backing had no such theory; it was simply a case of substituting an artificial back for the faulty or missing one, in order to economize on material. Yet now we read remarkable decriptions of the wonders of the backed bow.

To reduce the weight, or pull, of the bow, of course calls for reducing its depth. Observe very carefully how it bends when fully drawn. There should be some bend even in the handle of a self bow that is made with dips. Generally, taking off a little more wood in the dips —to be done with great care—will give the desired reduction. This on the assumption that the belly has been worked down to a moderate stack.

A lopsided bow is a most disconcerting development sometimes confronting the beginner. Such a bow is dangerous, whether still in the making or finished. Yet we see them not only finished but sold, and wonder where they come from. Apparently there are even those who make bows to sell who do not know how to cure the malady when it appears, and still are not above sending out such sick bows to afflict unobserving archers.

The lopsided bow is a product of one or more of three faults. If the beginner has done roughing out his bow and, having placed a string on it, discovers that it has the appearance of being about to reverse itself, he may learn what is wrong by checking up on these three points: First, the bow may not be wide enough; in which case there can be no cure. Or it may not be quite straight; if so, it can be cured provided there is enough wood left to work on. Last, while the bow apparently is perfectly made, one side (not one limb but one side of both limbs) is considerably stronger than the other and the wood persists in lopping to the weaker side. In this case it is necessary to take off enough wood from the stronger side to equalize matters, when the bow will be found to bend straight when strung.

Before proceeding to regulate a wry bow, try coaxing it. Grip the handle firmly in the bow hand, or if necessary in a vise, and draw the bow up gently, slowly. Repeat this many times. In most cases the defect will be found to have disappeared for good.

Regardless of how it acts when first strung, every new bow should be thus gently and carefully broken in. If it needs regulating, having been braced it should be worked down with a scraper.

Some time ago a well known archer sent me a bow he had made, and wrote me that it had bested him. Try as he might, he said, he could not cure it of turning over.

The bow was a delightful piece of work. It was straight, it was equally regulated, and to all appearances should have been all right. The first thing I did—indeed the only thing—was to string it up and draw it gently, a little at a time, to the full length of the arrow. This the maker evidently did not know he should have done. Then I sent it back, and in due time was complimented on the wonderful job I had done without reducing the weight of the bow!

Bruises in the completed bow are rather commonly disregarded. They nevertheless may tend to weaken the weapon, and of course are unsightly. These blemishes, whether to be traced to carelessness or accident, detract from the pride the archer may take in his bow, and should be removed. The process is simple, except where the fiber of the wood had been severed in the denting. And even then a partial cure may be effected without difficulty.

First place the bow in the vise, with the bruise up. Cover with a piece of thick brown paper fresh from a soaking in hot water. To the wet paper immediately over the bruise apply a hot (almost red hot) soldering iron.

Move the paper along as it shows signs of drying, but of course apply the iron over the bruise. In a few seconds the scar will be found missing, the wood having come back to its original level. Should you overdo the steaming, there will be a bulge. Then you must await thorough drying and rub the spot into its proper level with some heavy piece of smooth metal or wood.

Yes, such little tricks do bring the professional bowyer an occasional bit of easy money; but more important is the satisfaction that comes from bringing pleasure to the archers.

Assuming the bow has at last been found satisfactory in performance and having the desired weight, we come to the finishing. At this point, strange to say, the average writer on bow making instructs the pupil to secure a piece of broken window glass and proceed to scrape out all the marks, bruises and irregularities on the bow's surfaces before sanding. But glass is a miserable substitute for an ordinary steel scraper, sold for a few cents by any tool dealer, and the scraper will be found useful for other work as well and lasts indefinitely. The manner of sharpening a scraper is no great secret nor does it require extraordinary skill. Just file the edge perfectly flat and rub the blaze, or rough edges, away, then with an ice pick or similar piece of rounded steel, turn back a new edge. This will be free from roughness and will cut like a lance.

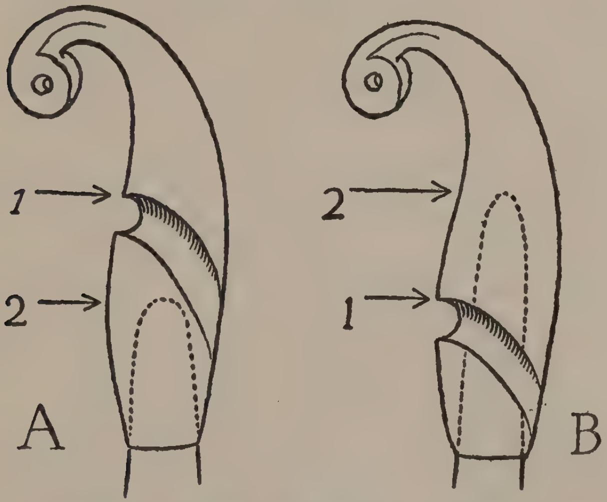
Some also recommend having the bow sanded on a power-driven sand belt. This method is about a hundred years old; but no professional bowyer with pride in his work will attempt the use of a belt. The manufactured bows, I know, are so finished; but the serious archer knows better than to accept the product of machine work. My advance is to use a hollow piece of cork lined with No. 2 sandpaper for the first rub. Then follow with No. 1 and finally No. 0. Once you have made a comparison of your job when finished with a sand-belt job you'll think no further of using the latter method.

For the polishing, I again have to disagree with the methods of the get-there-quickly instructors. The latest and best in varnishes would certainly appeal to me if they would produce the kind of finish I could be proud of. While they doubtless are excellent for fishing rods, the charitable thing to say of them as an archer is that the target bow is not a weapon which should be varnished. The best that can be said is that a good varnish like Valspar will keep water out of a hunting bow. The hunter being the only archer who, valuing his tackle, will still shoot in the rain.

To the archer who wants a good finish without too much bother and work, I recommend polishing with ordinary orange shellac. Take a piece of any old woolen cloth, such as the toe of a stocking, and pour on it a little denatured alcohol, to moisten and soften it. Add some shellac, and then cover with a piece of real linen, the older the better. Use this rubber to rub the bow thoroughly all over, so the shellac gets into the wood. Let the bow stand for a few minutes, then rub it down with a pad of No. 0 steel wool. Repeat the shellac processes until the finish is to your liking. The steel wool is never to be used after the first rubbing. In the first rubbing the alcohol raises the grain of the wood and the shellac enters as a filler. After this first rubbing the alcohol has more or less evaporated, and the wood being filled, the rest is polishing.

Do not attempt to use oil unless you are an expert.

Some claim that in using shellac or French polish, linseed oil should be added in equal quantity. This is wrong, as the result will show before long. At the time the work is being done it will appear excellent. But stand the bow up to dry, and as soon as the shellac begins to harden the oil will commence to sweat through, making the whole finish dull. It then becomes necessary to rub the oil off, or lift it off with alcohol, and this is work for the expert only. If the beginner attempts it he will find himself lifting off the shellac along with the oil. The oil is not required anyhow.



A. Showing nock above the extremity of wood: (wrong construction).

B. Wood extending up into horn safely beyond nock.

1. Nock in horn for string.
2. Extent of wood up into horn tip.

Last, comes adding the horns and the handle. The horns are from the tips of cow horns, turned to suitable form and size. These tips can be obtained unturned from pipe makers' supply houses, horn being used for pipe bits. The charge is the same, whether bought turned (finished) or untouched—a pair for 75 cents. File down the ends of the bow, obliterating the temporary nocks, and having shaped them to a good deep, snug fit in the horns, secure with glue. (See separate instruction concerning glue, page 78.) Then when the glue has set, file the nocks on the horns for the bowstring. Be sure to file them *on the wood;* that is, so the bowstring will pull on the bow itself, not on the horns out beyond the ends of the bow. (See diagram, page 71.)

The handle may be made to suit the individual preference. Take a flat piece of pine, whitewood or what you like, size 3/8+1-1/8+4 inches. Glue it on the back of the bow at the handle. Let the glue harden, then round off the pine and the square edges of the back side of the grasp with a rasp, to a comfortable shape for the hand. The additional bit of wood to round out the handle (the rounding of the belly at the grasp of completing the round) is necessary, as without it the bow would be hard to control. Cover the handle with leather or other material. A good foundation for this is a few turns of adhesive tape coated with waterproof glue.

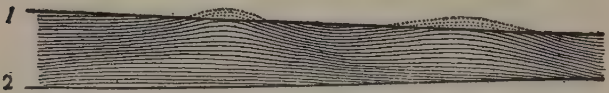
Just so is the first bow finished. I say first because it is strange if, having made one bow, the archer goes no further. The third bow, like the novelist's fourth book, is usually the first by which the amateur bow maker may fairly judge his success.

The first being a self bow, of modest stock, it almost surely will be followed by another "single stick," perhaps fashioned out of a fine lemon-wood stave, which leaves a bow still to be made of royal yew, and of course having everything to be found in the best professionally-made bow.

When he comes to working with yew, the amateur bow maker will find himself confronted with a harder task. Even the tools heretofore mentioned will need to be added to.

First, make sure to obtain, if possible, a pair of good staves of Oregon or Washington yew, preferably side by side from the same billet. And as the wood will almost surely be found to have many little twists that must be carefully followed without breaking the run of the grain, a drawknife, a rasp and a fine file for finishing will be needed in addition to the tools before mentioned.

The first thing to be remembered in working yew is to start from the back. I know this is the method I have given for whatever wood is chosen; but with yew it is an inflexible law. As previously mentioned, the sapwood of yew must always form the back. This lies next the bark of the tree, and is recognized as being a thin layer of tough white growth, the inner wood being red, like red cedar or redwood. The sapwood is indispensable to the life of a yew bow, unless some other form of backing is to be substituted; for without it the bow will almost surely break. Nor is the beginner advised to adopt the modern method of planing the back down flat, crossing the grain and breaking the run of the reed in order to get a straighter looking bow, even when the intention is to use a substitute backing of rawhide. And as for the latter, as far as my observation goes —and I carefully watch every progressive de-



Where no sapwood is left for backing, the flow of grain should not be cut into along the back of bow. 1. Line of "back." 2. Line of "belly."

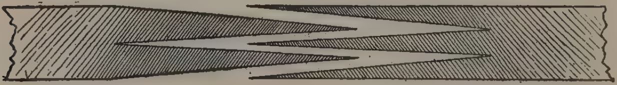
velopment that comes along—its only value lies in the fact that where a little splinter occurs (for want of the natural backing of sapwood) the glued-on rawhide will prevent the splinter from growing. In every other respect, there is no merit in rawhide on any bow.

In starting to work on a yew stave, first dress down the sap, or back, to a flat surface, gauging it to an even 3/16 of an inch in thickness, from the red or inner part of the growth. Then the work that follows is but a repetition of that previously described. Except that the warped growth of the yew at times compels using different tools, as already mentioned. The sapwood will be found much tougher than the redwood. Be very careful in using drawknife and spoke-shave, so as not to cut in too deep or start a splinter.

The method of making the fishtail splice in a two-piece bow—as of necessity most yew bows are—will be easily understood from the accompanying diagram. The limbs must be partly shaped, and the back of each limb at the handle fairly smooth. As will be seen, one limb is to have three prongs and the other two; it matters not which has three or two. Incidentally, if there has been any choice—as there usually is—the maker will have done well to select the least perfect ends of his two staves for the handle ends of the limbs, as they are not cut down materially, but the string ends are.

Diagram each half of the splice right on the back of the limb. Then very carefully cut the fishtails out with a tenon saw with its back removed. The cuts, of course being made from back to belly.

Nothing but hot glue is to be used for joining the splice. (See subsequent remarks on glue.) Melt the glue to the consistency of medium motor oil; for if too stiff it will cause the fishtails to spread. On the other hand, it must not be too thin, or too much will enter the wood. Two or three coats of glue are to be applied, the two parts of the splice placed firmly together and clamped in a vise. Before tightening the latter, align the back very carefully. If using an iron vise, protect the sides of the bow with blocks of wood. Screw up snugly and let stand 48 hours. Then proceed to dress down as with a self bow.



Fish-tail splice for a jointed bow. See page 76.

Often I am asked if it is a good thing to oil a yew bow to preserve it, and how often. The answer is "No." A little raw linseed oil applied at times, principally at the end of the season, is desirable, especially as the bow is about to be laid away. But continual oiling makes the wood soft.

The question of what glues to use in making bows and arrows is one I am reluctant to discuss. I am not giving instructions for building backed bows. And the majority of writers on archery are so positive that any one of the multitude of patented and newly invented glues is superior to the best hoof glue that I am strongly tempted to pass the subject by, as though it does not amount to much. Surely that would be the best way to keep the goodwill of these writers and other archers with whom I cannot agree. But there is a saying that fortune favors the brave, and besides I must not forget my trusting beginners; and so I shall say just a little here, and a little more when discussing arrow making.

During the war I worked in a carpenters' shop in connection with one of the foremost shipbuilding yards in the country. And there I had every opportunity of trying out every glue that came along—quick, waterproof, and every other kind, including casein glue. I am very familiar with the qualities of these patented, special, liquid and otherwise out-of-the-ordinary glues. But I still import my own glues. If I were interested in telling how to make backed bows—where a waterproof glue is needed—I should at least say that casein glue has a deal of merit for that purpose. One important point is that the amateur is of necessity a slow hand in working with glue, and hoof glue demands speed, whereas casein glue does not. Again, hoof glue will not stand much damp, and with it backs are continually coming apart from bellies in backed bows. If the use of casein glues will remedy this, then I should recommend it to you. However, my interest in backed bows, so far as this book is concerned, is nothing at all; for I am unwilling to encourage any one in any way, especially a novice in bow making, to spend time, money and effort on so risky an undertaking as making a backed bow, when there is no real excuse for such bows.

For your splice, when you come to that point in making your two-part bow of yew, you will do well to disregard any and all advice concerning newfangled glues and use the best obtainable hoof glue, known as cabinet maker's or joiner's glue. Or should it be probable that this bow will be exposed to dampness, as in hunting, then use casein glue.

CHAPTER VI

THE BOWSTRING

MUCH has been written on the subject of making bowstrings. Perhaps because for over five hundred years the Belgian bowstring makers have had an almost complete monopoly of the bowstring business. That this has inspired the writing of meaningless instructions may or may not be so. Surely it would have been more risky had the Belgian method been common knowledge and capable of adoption. Still, there have been some practical directions published; for the world war taught the archer the value of acquiring a measure of the art, so long kept secret in Belgium, handed down from one generation to another in the same families. And should the reader wonder that nobody could learn the secret from examining and even dissecting the Belgian strings, let me say this. I have submitted Belgian bowstrings to the very best American makers of hand-laid linen fishing lines, which have been made the same way, by the same families, for more than one hundred years. The world record lines, famous for their excellence; twisted out of flax as a bowstring is made. And yet these expert line makers could not duplicate the Belgian bowstring. "It is the queerest thing I ever saw," said the head of the business, a man over sixty years of age who all his life has been an expert in the making of hand-laid twisted linen fishing lines. "I've never seen any flax like it; the strands are amazingly long. We couldn't make up bowstrings made in just that same way for anything like the price you sell them for. We would like to make bowstrings if we could do it at a profit, but it is easy to see that we are shut out."

Nevertheless, when during the late war the real Flemish strings could not be had, a multitude of bowstring makers suddenly appeared. And so I am going to tell how a practical substitute for the Belgian string is made. But before starting, let me say that, no matter whose directions you may follow, you cannot turn out bowstrings equal to the Flemish make, nor, as far as my experience goes, will your strings be anywhere near as cheap as you can buy the best from over there.

By all means, let your first bowstring if possible, be one of good professional make. Then if you have the courage and skill to warrant attempting production of your own, well and good. And before taking up the directions I will add that my reason for giving them is really more to tell how a bowstring is made (but not in the Flemish style), rather than to tell how to make one. Still further, let me say that, if you insist upon making your bowstrings, it will be better to start with them already partly made for you and simply do the finishing. From any first-class cord dealer you can obtain a variety of real Italian hemp already twisted into string, that makes a better bowstring than anything you may ever hope to produce by your own hand. As while admitting that one can but admire the ingenuity of an archer who makes a good string by hand, the want of the stretcher and the heckle is always apparent, and the string inclined to be rather soft. A soft string, by the way, not only wears badly but affects the cast of the bow.

The advantage that the Belgian bowstring has over the best we can produce lies in the fact that it is still one solid mass of hemp after being carded and cleaned. After the eye has been made by hand, a spinning machine neatly spins it to the required cording, the maker at the same time adding the sizing. Lastly, the maker hand-finishes the end, which must be strengthened by weaving in reinforcing and at the same time making a cord finish, needed to stand the wear and strain of the bow end.

The first problem is to secure the best substitute for that wonderfully long-fibered Flemish flax. While we have the best in the world so far as strength is concerned, our American flax is too short to make a satisfactory bowstring. The best substitute for the real Flemish, that we know of, is Barbour's Irish flax. This can be had in almost any large city, in either skein or reel, and the thread spun of almost any degree of thickness desired. Thus a bowstring can be made of this material with anywhere from twelve threads to forty to the single string. The proper number to use is beyond me to say positively. My preference (and I get very few broken strings, no matter what the weight of the bow) is any number of threads and the greater the number used, the better the string. However, this is only a matter of personal choice. Naturally, the string must be small enough so that, when whipped, or bound with waxed linen thread at the center, it still will not wedge in the nock of the arrow. The average diameter is about 3/32 of an inch. A skein of flax is ample for one bowstring.

Having found the length of the string desired, lay out on the workbench a space 9 inches longer than this, and drive a nail into the wood at each end. Then, taking your reel of finely spun flax thread, proceed to wind the thread around the nails, from one to the other. When the threads taken together assume the approximate thickness desired, cut your small skein thus made right in two at the nail where you started to wind. Holding the accumulated threads, which you will have removed from the other nail, divide them evenly at the loop and wax them there (where they formed a loop around the nail). This waxed place, when again looped, is to become the base of the eye or loop at one end of your bowstring. There will be no eye at the other end.

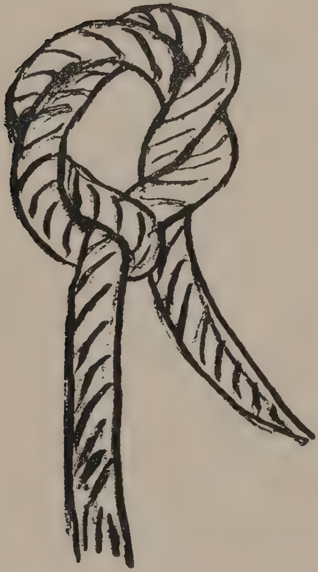
Count the number of threads at the eye; not the number doubled, just those threads which actually form the eye. There will be half the number you have in the doubled length of your budding string. This means the eye must be reinforced, to give it necessary strength and durability. Add an equal number of threads, well waxed and cut to a length of 24 inches, placing them beside the base of your loop. Add still another equal number of threads, waxed and 24 inches long. Now you have *three* separate collections of threads, each set well waxed. Take each and twist it, cord fashion. Last, having your three cords, take the long one, double it, and weave the two short ones together with it so as to form the eye and its splice. I shall not attempt to describe this; the best direction will be found in a careful examination of a professionally made bowstring. It will be noted that where the splice starts, it is twice as thick as the eye. This is reduced by taking out several of the shorter threads at each alternate turn in the roping, so that the splice gradually tapers into the string. The last of the short threads (12 inches long when doubled at the loop) will lose itself in the bowstring below the splice. Now rub in more wax, to bind the eye.

By drawing your fingers through the length of the string, any tangles in the threads may be removed. Then the string is ready for carding—as far as already spun thread can be carded. The rest is only a matter of care in laying the twist, or cording as in rope making, stretching at the same time, gradually tightening, and always seeing to it that there are no slack threads. Do not use an excessive amount of twist, as this will weaken the string; in fact, very little twist is desired in the string away from the reinforced ends.

Having placed the eye of your bowstring beside the nock at one end of your bow, as it lies on the bench, you will need to commence reinforcing the string when the roping process approaches the other nock. This should start about six inches inside the other nock of the bow when the bow is not braced. The filling need not be more than one-third the total number of threads in the bowstring. These should be introduced gradually as the roping proceeds, and carried past the length of the nock, then tapered out. There is to be no eye at this end, and the reinforced part is to be well roped, or twisted, and finished with a good waxing.

To finish the bowstring, take a mixture of linseed oil and glue, and rub the string strenuously with this, using a grooved piece of horn or other equally hard instrument. Continue until the string is a solid whole. Finally, allow the string to dry, then stretch it by hanging a heavy weight to the loose end of it for a few hours.

Bowstrings having a loop at each end are commonly sold, especially on manufactured bows. These, of course, cannot be adjusted; and it is easy to understand that each bow



The Timber Hitch as shown is the proper knot for use in adjusting the bowstring to its place. In addition to strengthening the bowstring at the eye where the wear is most pronounced, it has the advantage of being a non-slipping knot. The reader who is not familiar with the making of this simple knot is advised to carefully follow the diagram as a start.

should be braced to suit its own individual bend. The bowstring with but one eye provides for obtaining the right adjustment of string to bow, the end without an eye being tied to the nock. The eye must be large enough to enable unbracing, yet not so large as to permit slipping from the nock. All of which should impress the reader with the wisdom of having a good professionally made bowstring (Belgian preferred) to copy.

The best wax is a combination of equal parts of *pure beeswax* (not any of the substitutes) and *resin.* Melt these and while soft mix into a ball. It will be found in assembling the wax and the resin that the latter seeks the bottom, while the wax wants to float. To get the proper result, work together into a ball while soft, holding the ball under hot water. Then, being satisfied the mixture is as wanted, run a little cold water over the ball and the wax is ready for use.

Before use, the bowstring must be whipped at its center with waxed linen thread, to protect it from being cut by the arrow nocks. Whipping should be finished at each end with the invisible "knot," as used in whipping a fishing rod with silk. The extent of this whipping need not be more than three or four inches.

CHAPTER VII

ARROWS

As I intimated in a previous chapter, the average beginner in archery has very little conception of the importance attending the making of arrows for serious use. On the other hand, the accomplished archer is as finicky and exacting about his arrows as an expect rifleman is concerning his match ammunition. The fact is, the arrow must be considered as a highly specialized missile, with flight efficiency affected by many variable factors. Added to the problem of flight efficiency is that of durability. Just think it over, and there soon will be an accumulation of reasons why arrow making is no ordinary task. Learn something about it and it becomes a real art, and the value of a really good arrow multiplies in your estimation.

At first the archer desiring to make his own arrows is impatient of such difficulties as inserting a footing and a nock of material different from the shaft itself. He finds enough difficulty in producing satisfactory shafts without adding these desirable reinforcements. Difficulty too in doing the feathering satisfactorily. However, for the best understanding I shall cover the whole subject, of making suitable arrows for target use. Hunting arrows I shall not discuss, instead referring the reader to Dr. Saxton T. Pope's exhaustive book on hunting with the bow. There are many differences in hunting arrows, perhaps the greatest being in the points used. Naturally, the kind of arrow to use depends largely upon the kind of game it is to be shot at. Unfortunately, there seem to be no two hunters who believe in the same kind of hunting arrows. In other words, there is no set standard. Consequently no professional maker will give the time and attention to this branch of the craft that it really needs.

With no little amusement, I read some astonishing statements about arrow making, written in all seriousness by archers looked up to as authorities. One of these tells of the old-time makers in England, and the fine arrows they produced. They could have enhanced their great reputation, I am told, by using some other wood than Scotch pine for their shafts. This surprises me; for I spent nearly eighteen years among the best English makers of archery equipment, and many a time was set the task of visiting the importers for the purpose of selecting genuine Norway pine.

I wonder how the impression originated that the English arrow makers used Scotch pine. I wonder if it really was done, say a century ago. When I think of the Scottish pine—that is, if the wood referred to is intended to mean the pine grown in Scotland and not some other growth called by that name—I cannot imagine any one ever attempting to make good arrows from that class of wood. I would just as soon go out after the Christmas holidays and gather up the discarded Christmas trees from which to make my arrows.

Oddly enough, the archers accept these queer tales and look askance at the old bowyer if he so much as shakes his head at them. Here is another example, and one we of the craft can not laugh off. There is a belief extant among the writers on archery that wood of fine grain is superior for arrows to that of coarse grain. As a matter of fact, the grain of the wood does not affect the quality of the shaft. Every professional arrow maker has known this and reiterated it for many a year. Yet the archers keep right on demanding the close-grained shafts.

Again, the word "deal" is often used in writing about arrow woods. We read that those same mythical old makers "who knew their business" relied entirely upon deal for the best class of work. The archer studying such an authority, upon setting out to procure some deal finds after long search that "there ain't no such animal," as the saying goes. Neither lumber merchant nor architect has any knowledge of what is meant by deal. Often enough, the archer then writes to me to find out. He seldom presumes that I may have some to sell; he just wants to know what's the other, or maybe the American, name for it.

In England, deal is a word used to designate the size of timbers used in building and for other purposes. For example, a baton is a timber of 2 inches by 7 inches or under, while a deal is a timber of 3 inches by 11 inches or over. Thus it is easy to understand the use of the term "old deal" by arrow makers of England. Heavy timbers obtained from old buildings being wrecked are sure to be thoroughly seasoned. And such timbers until lately were mostly if not always, the very finest of arrow wood, genuine Norway pine, grown in Norway, Sweden or eastward along the Baltic coast—most of such deal timbers when obtainable had been seasoning for hundreds of years. And their size, not less than 3x11, should indicate their abounding in clear stuff, free from knots or twists, and not cut up with checks.

Being thoroughly familiar with this custom of the old arrow makers, and by chance being in Scotland, I not long ago had the opportunity of obtaining some of this old deal. They were wrecking an old building in Princess Street, Edinburgh, and out of one or two old deals I secured, I cut some of the finest arrow wood I have ever come across. There was enough of the timbers to warrant making quite a shipment of it home to the States; but unfortunately I found it so full of spikes as not to warrant salvaging the usable parts, and so I had to satisfy myself by purchasing new (unused) Norway pine—which of course I must patiently wait for while it seasons.

There is a good amount of this old deal coming out all the time; for they are wrecking a great many old buildings in Great Britain now. But it must be remembered that there is a demand for all usable timbers, at a good valuation—nails and all. Nor are the builders alone in being on the lookout. There is literally no end of cabinet makers who are interested. And if they aren't enough, there is a multitude of violin makers, and makers of other musical instruments too, who want the old deal and are in most cases willing to pay more than the arrow maker can. Getting a good supply of good clean stuff is largely a matter of luck and being on the spot.

Of course it will occur to the reader that old buildings are being wrecked everywhere. But unfortunately, the splendid white pine so often found in such cases in this country is not Norway pine from Norway. White spruce, however, where found, is to be snapped up at once. Black spruce is not in the same class, being smaller and comparatively knotty. Douglas fir is also very good.

Perhaps the best way to obtain some of this old arrow wood is to enlist the interest of an elderly builder, who perhaps can recall the time of erection of buildings being torn down and tell you what to expect there. He too perhaps can best identify the wood for you. But don't babble to him of old deal, for it is not known in this country.

While on the subject, I am reminded to say a word or two about famous arrow makers; because here too there is room to correct popular misconception or rather to scotch a fallacy. I have in mind the empty reputations of some famous arrow makers, and the tendency of archers to blindly accept mere reputation on its face, without knowledge of its foundation or lack of it, and with apparently small interest in being their own judge of an arrow's quality.

For a great many years English archers relied explicitly upon the reputation of certain arrow makers whose names are high lights in the literature of the sport. And likewise many of the best archers in this country; in fact they are even to-day to be found claiming that arrows made by this English firm or that one are the best that can be bought with money. One prominent archer swore by Aldred's arrows, another by Buchanan's. There were others who would have none but Muir's, and still others just as positively wedded to the Highfield arrow. To read and hear of these preferences has often amused me not a little; for my observation during my connection with the archery goods business in England made it clear as day that the archers, past and present, too often attributed merit to arrows for their name, not for their actual merits. I was not long in finding out that Peter Muir, for example, never had been able to make a really good arrow. His great reputation was built, not on his own arrows, but instead, on the work of Dick

Thompson, who for nearly sixty years made the celebrated Muir arrow—the same Dick Thompson mentioned in the preface of this book. Nobody ever heard of Thompson as an arrow maker. Again, I was manager of the archery department for Buchanan, and I later took over the firm of Highfield, and so had plenty of opportunity of seeing things as they were under the roofs dignified by these great names. During all the many years I was in London, the finest arrow maker known to me was Harry Purle, whose name is utterly unknown to archers. And Purle made the arrows for Aldred, Buchanan and Highfield, all three! Every arrow, whether an Aldred, a Buchanan or a Highfield, was in reality a Purle, as the Muir arrow was actually a Thompson. The proprietors each contributed their famous identifying stamp, and charged according to the cost of maintaining their business houses, which in turn was governed by the location. Yet for all this, the archers apparently found a great deal of difference in the various makes and swore by their favorites!

In this country, forty years ago an arrow maker named Grainger was said to be a wonder. Whitman was also a name to be conjured with. The arrows of these men doubtless would have compared favorably with those of the best arrow makers in any country. Old-time archers still speak reverently of their work. I have no knowledge of their methods or the woods they used, but I believe they used white spruce, principally. Those were the days when there was plenty of it, in big stuff, and I fancy the canny maker went himself to the sawmill and got some choice cuts from butt logs. The butt log of a big tree is, of course, the part in which the fibre is toughest. This wood is especially to be preferred in spruce. Spruce in the average is light, so this heavier wood in the butt log is still light enough; and its greater toughness affects the tendency to brittleness of the higher cuts.

The early American makers doubtless used other woods, too. The temptation to use pine surely must have been great, there was so much of it, wonderfully good pine—white, yellow, Southern, Western, but best of all, when cut from the butt log of a true patriarch, hard or white pine. But the American pines, though splendid of growth, are not equal to native Norway pine. Best of all, I would say, would have been some of the western woods, if obtainable. The Oregon fir, Douglas fir, and sugar pine, are some that occur to me.

Spruce of the right kind is my second choice for arrow wood. It is easily obtained, and as previously said is tough and light. Were it not somewhat brittle it might well be classed about as good as any wood ever tried in arrows. In the choice of spruce, I find there is a particular growth sought by the makers of ladders, that is excellent for arrows; always provided the buyer takes care to avoid the center wood, also the red, brown and cross-grained growths.

I have used a lot of Douglas fir, when no other suitable wood for arrows was to be had at any price. The archers did not permit me to be the judge of its merit; they quite emphatically reported the wood not the best. And yet, at times you may get good arrows out of it. It is like spruce, except the return appears to be somewhat slower; which, however, will not affect the shooting of the archer who uses a bow of medium weight.

As to other woods for arrows, I need but repeat what has been said of innovations in bow woods. The professional makers have all culled over all that the forests of the globe have to offer, I am quite sure, and if better wood was to be found than Norway pine, from the shores of the Baltic, or our white spruce, it certainly would have been in use long ago.

Selecting and seasoning arrow wood calls for the exercise of considerable care. It must not be too heavy, and the way to make sure is to take a sample and make and weigh an arrow. Next, the grain of course should be straight, and knots avoided. Sapwood or the outer sides of the wood *must be discarded;* this is useless for arrow making.

The method of seasoning is simple. Select a dry place with a fair amount of heat, and if possible some draught. Stand the wood (which should first be cut into suitable lengths) on end and leave for at least one full year. At the end of this time, cut it up into the desired arrow staves, which should be fully ⅜ of an inch square. Then stand these up on end for further seasoning, as near the ceiling of the room as possible. At intervals during the year, turn each stave around and reverse the ends. Continue this treatment for three years at least. And that is all there is to it.

I have said so much about real Norway pine that I perhaps am discouraging. However, as this, in my opinion, is the best wood for arrows I must present it fully. Genuine native-grown Norway pine is a different wood than the so-called Norway pine grown in this country. I have tried Norway pine from every part of the

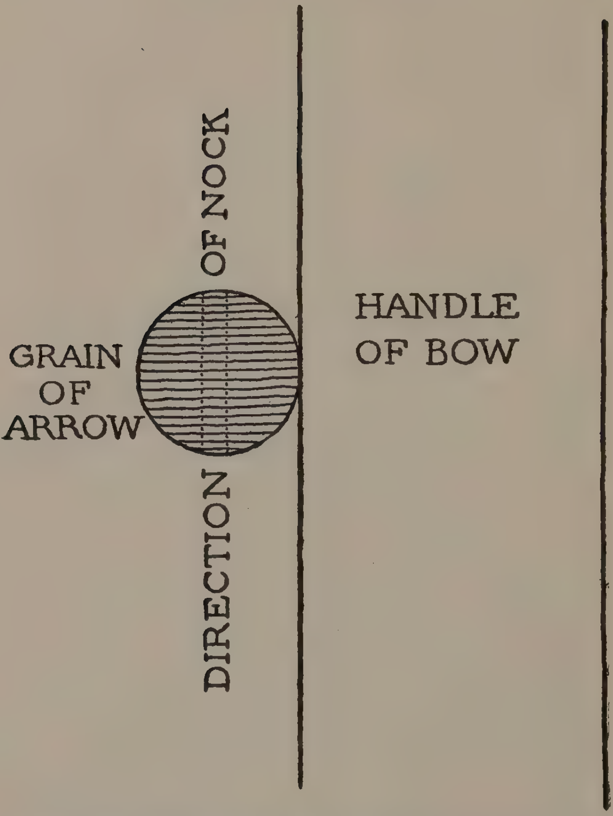
United States where obtainable, and allowed the archers to be the judges. And hundreds have declared the best to be had did not compare with the imported wood. The real stuff is shipped from Memil, on the Baltic. It is classed as a sort of bastard yellow pine, and is very rigid, yet still springy, and just light enough to make the best arrow for target work. Its gummy nature is such, however, that it takes at least five years to season properly. Indeed, the longer after that period the wood can be left the better it becomes.

Unlike yew (unsuited for arrows, of course) native Norway pine can be dried out first in a kiln, if the heat be not so great as to kill the wood.

Most of it grows as straight as if drawn with a perfect straight-edge, and it can be had with the so much desired—yet really unnecessary—close-reeded grain. The return, or speed of come-back to normal from a sprung position, of real Norway pine is second to none. And the rule is, the quicker the return the better the spine.

To speak of the spine of an arrow has been to refer to its stiffness. But this is a term which is undergoing a change. The claim that any stiff shaft has a good spine does not hold good, as far as my knowledge goes, because a good spine really calls for spring, not absence of it. For example: When the bowstring is released in shooting an arrow, the string takes a direction toward the center of the bow, the arrow thus being forced to the left, according to the width of the bow. At the same time, the arrow is passing the bow on the side of the latter, and if it is to go true must follow its pile, or point, and not be deflected by that side drive of the string. Just so. If the arrow is absolutely rigid, you may count on the shot being deflected to the one side by the action of the string being toward the center of the bow instead of toward the edge. If, however, there is spring in the shaft, the sudden force behind it will put a little bend in it, and this momentary bend aids it to "get around" the bow on a straight course. Having done this, however, there is no more need for the bend; on the other hand, it must be gotten rid of as quickly as possible, for a bent shaft will wobble. Now, if the shaft lacks spine, does not quickly return to straight, the arrow may almost reach the mark before it ceases to wobble. But if the return is quick, a straight flight is the result.

In the foregoing description, for the sake of clarity, I purposely omitted mention of the com-



With bow held upright, the grain of arrow should be flat, at right angles to line of nock, string and bow.

pensating whip the feathered end of the arrow receives just following the return of the spring to tension. This throws the arrow back on its true course.

There is no known way other than by shooting, to determine whether an arrow be of good spine.

The length of an arrow is, as previously stated (in connection with bow making), fixed by the draw of the bow, the standard length for men being 28 inches, that for women 25 inches. As to weight, this is determined by what the arrow is wanted for. Thus an arrow weighing 4/6 (four shillings 6 pence in silver, English money, the avoirdupois weight of the coins; see Chapter VIII, on weighing) with a bow of 50 lbs. or over, will be found weak in the spine, consequently wobbly and useless for fine work; but the addition of 3d in weight (silver) will mean a thicker shaft and accordingly better spine. I have watched the varying moods of the best archers for over thirty years, and find to-day that the old-time 4/3 arrow has been superseded by a demand for an arrow of 4/9 to 5/— for the heavy bows, and even for the shorter ranges where the bows are lighter. Out of 168 dozen arrows made in 1925 there were 92 dozen 4/9, 69 dozen of 5/—, 7 dozen of 4/6, and not a single arrow of 4/3. All arrows of the standard 28-inch length.

CHAPTER VIII

MAKING ARROWS

AN arrow is such a little thing, and so simple, that the reader who has made no study of arrows and is without experience in making them must surely be impressed by the number of pages occupied by this chapter and the next. I admit I would rather say less. For the purpose of the average reader, too, I might indeed cover the subject in half as many words. However, this is the only book I shall ever write, and being a professional maker of arrows and an archer of standing, I am expected to do more than merely give instructions for making a dozen or two of arrows. If for no other reason, I must air my views and tell my own methods to prevent it being said that to judge from my book I know mighty little about making arrows.

To begin with, I must at the very outset confess to occupying the unenviable position of finding myself a minority of one. Up to the time of writing this, every other writer on the subject of arrow making is opposed to me in my views as to how to start on the making of an arrow. The methods of the great arrow makers of times gone by are all ranged against me too. I speak now as a professional maker, not necessarily as instructor for the amateur. Up to the time of this writing, so far as I have read, no arrow maker who took pride in his work ever would attempt to turn a shaft on a lathe. The claim always has been that any tool cutting against the grain tends to weaken the shaft; or if the process is a grinding one then the heat engendered injures the surface wood. Whether this be so or not I am not in a position to say with any degree of certainty; although I have studied work done by turning which passed very careful tests. But, anyhow, I approve the use of a machine. In my opinion there is not a reason in the world why the arrow's shaft should not be turned down to nearly the desired diameter, for the considerable time and labor saved. Moreover, machine work might go further and aid in fitting on the point, the insertion of the nock, and more. Strangely, though, it is necessary to remark that such use of machinery tends to increase cost; this for reasons touched upon in the chapter on bow making.

Under the orthodox method of the majority which so vastly outnumbers me, the first process in arrow making is to square the shaft, seeing that it is perfectly straight. This is accomplished with a plane. Next, the orthodox maker takes the footing (in the case of a footed arrow) and with a band-saw set to gauge runs a cut down the center. Yes, our exclusively hand-work arrow maker actually does use a machine, you see. He cuts his footing. Then taking the squared shaft he tapers one end nicely to its exact center, and after that forces shaft and footing together, fastening them with glue, the taper in the saw cut of the footing. Next he saws off the wings, or surplus ends, of the footing, and the arrow shaft is ready for rounding. If the maker has a lathe or other machine, you may be sure he uses it to do the bulk of this work. Rounding completed, the arrow point is fitted, and this can be done with the aid of a cue-maker's tool, a little machine which permits of adjustment to a thousandth part of an inch. Next follows inserting the nock, and making the notch. Then, though I have not seen it mentioned in what I have read, I presume the arrow should be weighed out to the desired weight. After that, and the feathers are attached and cut, when the arrow is painted and polished it is ready for use.

If I have appeared somewhat hurried in passing over the above description it is because the method given is that which the archers have been instructed in many times. And, if I must say so, also because it is not the method used by the professional makers.

And now, as one who has little time to spare in experimenting—as the leading amateur makers do, with profit even to us professionals—I give the professional's method, and some explanations for his using it.

The professional arrow maker works in direct opposition to the foregoing directions right from the start. His first task is to select his arrow staves, weigh them out to approximately the same weight, making weight by use of a plane. All will, of course, be cut to the same length. This done, he rounds the shafts. And having little faith in a machine-turned arrow shaft, he does the work by hand (I being the exception here too). In this he uses two casement planes, sizes ¾-inch and ½-inch, for the final touches, the whole job being quickly done and worked with the grain of the wood. Incidentally, it is well to mention here that the handling of these planes appears to be a source of worry to most amateur makers. They declare that the plane runs the shaft down too much at the far end and spoils the work. In such cases, the trouble is the worker is bearing a little too heavily on the front of his plane, and not on the rear as he should do. If the latter is done nothing can prevent making a perfectly straight shaft.

To the amateur arrow maker this contrary way of ours may seem absurd, and perhaps it does take up more time. But there is method in it just the same. After the shaft has been turned and before the footing is attached, we test the shaft and discard it if it is found unsatisfactory. As no perfect test of an arrow shaft can be made before it has been rounded, this prevents waste of time and material in footings put onto unfit shafts. So if our method take a little longer it nevertheless is the more practical one for the worker who must conserve his time and materials.

Having rounded, weighed, and sized a collection of shafts, the next work is to attach the footings. This is done as already described. However, considerable more may be said about footings and putting them on.

Satisfactory footings may be made of quite a variety of woods; but there is a limit. For instance, such hard woods as snakewood, ironwood, washaba, will never prove satisfactory for this purpose. They are exceedingly hard and will not act in conjunction with the softer woods used for arrow shafts. A hardwood will take a set in opposition to the pine or spruce, with the result that the arrow will warp. Every year I receive numerous arrows to straighten which have gone wrong from this defect. Arrows, by the way, that I would rather have made in the first place; because the only cure that I know of is to remove the footing and substitute one of suitable wood. In my experience lancewood, lemonwood, beefwood and others of similar character are the best for making footings. They are not too hard and should be used in preference to any other wood.

The most desirable length in a footing is about 7½ inches. This seems to give the arrow the most satisfactory balance. If a shorter footing would do, then one might as well abolish its use and instead add weight to the point of the arrow. However, when the latter is done the balance is not well distributed. (An arrow, by the way, must balance at a point forward of its middle.) It is claimed that this has been proved by actual experiment; but I have no actual knowledge of the details of this demonstration.

With shafts and footings at hand, we first cut each footing down the center till there is but 2¼ inches of solid footing left. For this any suitable saw may be used, but the cut must be very carefully made, to get it straight down the middle of the footing. The footing, of course, being merely a short shaft of harder and heavier wood than the main shaft, but as yet left square with a diameter of ⅜ inch.

Next we take up a shaft and draw a pencil line across the footing end, dividing it exactly in the center, *with the line drawn with the grain,* never across it. This in order to make the grain side the striking side in passing the bow, as the return will be much quicker than if the rift were to pass next the bow. Again, in the case of a splinter developing, it would be most unlikely to appear in the grain, but nearly always on the rift. An arrow with a raised or splintered side passing the bow in shooting will fly anywhere but true to the mark.

With an iron plane set rather fine, we proceed to taper the shaft from each side of the line drawn across the end. This taper must measure ¼ inch less in length than the saw-cut in the footing. It must be a straight, flat taper with an edge at the end the thickness of the saw-cut made in the footing.

I have discussed glue in a previous chapter, and need only say here that any glue the arrow maker prefers may be used. I am partial to the best hoof glue, which I am particular to get only from one source overseas. As to using this, I know it is true that there are many glues that are superior to it in that they will allow of an arrow lying out all night in the rain without the footing coming off, which hoof glue will not. But my opinion is that in such a case the arrow will suffer more than the gluing, and if it were mine I should prefer that the footing did come off. Because in most cases it would have to come off anyhow, to enable straightening. And if it were put on with casein glue I would be at a loss to know how to remove it. Doubtless I would have to resort to the method of straightening so often recommended but never a cure: warming the arrow over heat, then bending.

Having applied the glue to the wedge-shaped end of the shaft and the saw-cut in the footing, the former is to be forced into its position in the footing, spreading the latter apart. Bind with cord to hold in place, then align carefully so that when the glue has set and the cord and the surplus wood of the footing have been removed the footing and shaft will run together evenly. We all too often see arrows having a longer footing wing on one side than on the other.

A binding of hard-twisted linen or cotton fishing line is the most satisfactory for wrapping around the footing wings after the gluing. I have observed the use of various clamps and rings, devised to help the arrow maker in this detail of his work, but never have seen anything so practical as a few turns of this light strong line. Twelve-thread Cuttyhunk is about right, and a dozen or two short lengths will serve the purpose for years.

Two difficulties are liable to crop up at this point, to force the footing out of true with the shaft. One will come from the saw-cut not being in the center of the footing. One wing of the latter being stronger than the other, this forces the alignment to one side. While the glue is soft the stiffer wing may be bent to line things up; but you must make sure the binding holds that position while the glue sets. The other cause of difficulty will be in the taper of the wedge end of the shaft not being centered, or cut equal on both sides. It can be remedied in the same manner, but with less certainty of success.

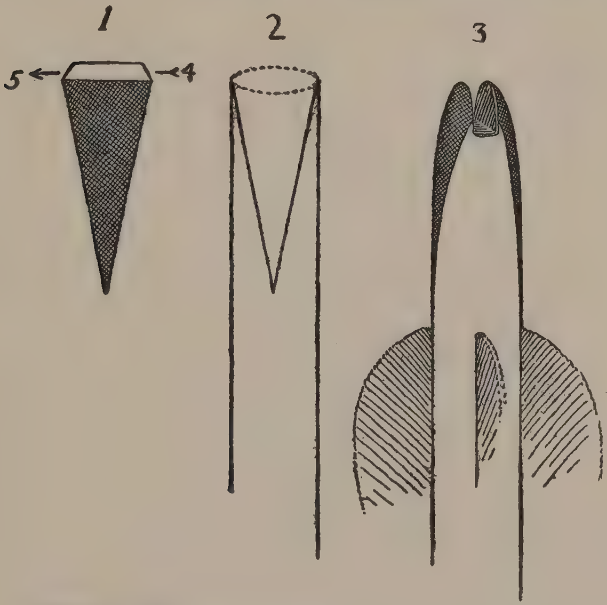
Then, of course, there also is the trouble to be expected if the footings are not of the right kind of wood.

When the glue of the footing joint has dried and the wrapping is removed, the first thing is to take off the wings. (I am getting used to this modern name; nevertheless it is well to mention that until lately all arrow makers spoke of the protruding ends of the footing as tails.) They may be sawed off or planed off. The average archer will do best to remove this surplus wood with a jack plane and finish with an iron plane, at the same time taking off the square edges of the footing and rounding it to match the shaft.

To fit the arrow point, some professionals use the little cue-tip fitting machine, previously mentioned, with great success. But with patience and care an ordinary knife or a chisel and a file will serve very well. The footing must be socketed—that is, shaped down and fitted snugly in the hole drilled in the metal arrow point—and fastened in with cement. I find that Collins cement, costing 10 cents a tube, serves as well as anything I have used. This can be had in any 5-and-10-cent store, and a tube will fix the points on a gross of arrows. It is a good plan to fill the hole with cement and insert the end of the footing, then heat the point over a gas jet and press it home when the cement begins to boil.

Next comes making and inserting the nock, if the orthodox method of arrow making is followed. But here again the professional goes a different way. With us, the nock waits while the arrow is weighed out to the weight prescribed. The maker sets out his scales, with the proper weight in place (I use the English coins themselves), and with his finest casement plane carefully works down each arrow to the right weight. It is common knowledge among archers that arrows are slightly tapered at the feathered end, and for some reason not so well known. Not a little profound comment has been written about this puzzling feature. But the only thought in the mind of the non-comittal arrow maker when doing the tapering is to take off a little weight where it will least disturb finished work. The shaft being considered just right, and the arrow still being found too heavy to match the others, he planes off the excess from the part which will be feathered, that being where thinning down will make the least difference in the arrow's performance.

For the nock, a wedge-shaped piece of horn or of compressed fibre is wanted, to reinforce the soft pine or spruce. In the shop, machinery can best be used to cut the V-shaped mortise in the end of the shaft; a special cutter should be used for the purpose. But the average archer must depend on primitive methods, and the nocking should be done somewhat as fol-

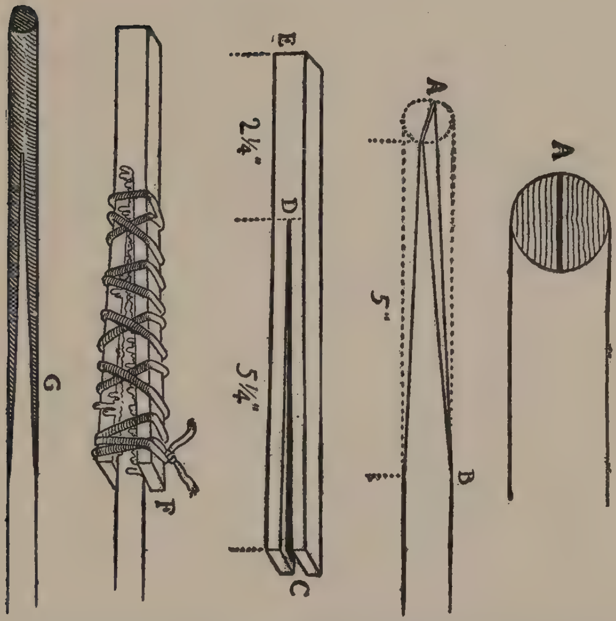


1. Wedge of fiber.
2. V-shaped cut sawed into shaft.
3. Fiber wedge glued into shaft, nocked and rounded off. Nock is cut across top, at right angles to taper of wedge, from 4 to 5, and so cuts into extremities of wood of the V.

lows: Draw a pencil line across the end of the shaft with the grain, or in line with the wedge end glued in the footing. Continue this line down each side of the shaft to the depth it is intended the nock is to occupy. With a very fine saw, such as dovetail saw or the finest hacksaw, cut out the V, as shown in the accompanying diagram. Cut out the nock to fit, fix it in place with glue and bind with the same cord used for wrapping the footing.

When the glue has hardened, finish up with the casement plane, round off the end of the nock and then cut the notch. Here again a machine can do the work better than it can be done by hand; but the notch can be cut satisfactorily with a hacksaw. Use a blade ⅛ inch thick, or better still, a number of thinner ones with fine teeth that together make a ⅛ inch cut. The depth of the cut should be about 5/16 of an inch. Use a flat file to clean out and smooth off the cut. The inside should be slightly rounded and perfectly smooth. Finish the outside with sandpaper. Oil is to be used inside the nock, but never varnish or shellac.

Now for the finishing. This can be done in various ways with the results equally good. But the best that I have been able to discover calls for the use of a lathe. Place a solid block



Across end of shaft, mark a line running with the flat of the grain, (A). From a point 5 inches upward, plane down the shaft flat, (B to A). Saw down the middle of footing 5¼ inches, (C to D). Leave 2¼ inches head, (D to E). Spread glue on tapered shaft, and into crotch of footing, then insert shaft, B-A, into footing, C-D, wrap with string and let glue dry. Next plane off edges of footing, F, to the proportions of shaft, G.

of smooth wood on the lathe, level and of the proper thickness so that when the chuck grasps an arrow by the point and the lathe is set going the arrow will revolve flat on the block. Then take a hollow piece of wood about 12 inches long (if possible use an old hollow plane, such as a bead plane or a casement plane) and line the groove with No. 1½ sandpaper, glued in. Spin the arrow and run the sander along it, and be glad if you have left about 3 pence or 21 grains for this additional reduction in the weight of the shaft. The block will afford the necessary foundation so the sander will produce a perfect round, eliminating the little hills and hollows. Last, take a fine piece of sandpaper or a piece of the coarser which has had its keenness worn down, and hand-rub the shaft the way of the grain until the finish is satisfactory, watching carefully not to go below the weight desired.

A good many of the experimenters in arrow making are great believers in a nock formed out of a tube of either aluminum or fiber, placed on the shaft in the manner of a cap ferrule. They claim that it is much stronger than the kind of nock I have given directions for making, and less easy to be damaged if hit when in the target. I am continually asked why I do not use them. I have in fact fitted many arrows with these nocks, but the preference of the archers, who are the real judges, was against them. As for my own opinion, I found in shooting with arrows having these ferrule nocks that when such a nock was hit, in the manner described, it amounted to the end of the arrow unless one was prepared to make a double joint. As that meant a new end to the arrow, with its new nock, feathers and paint, the cost of such a repair was nearly that of a new arrow. Then again, one could not use these nocks without trimming down the end of the shaft and making a shoulder. This weakened the shaft. The last and most important objection was, these nocks necessarily were of a set size, consequently in using them any reduction in order to obtain exact weight must come off either the shaft itself or the footing. No arrow maker with a reputation at stake could make weight in that way.

CHAPTER IX

MAKING ARROWS—*Concluded*

WITH the arrow ready for feathering, or fletching, as we have it from the old-time makers, it doubtless seems to the uninitiated archer that it is almost done. So it is, in a way. An expert fletcher will have it ready for finishing quickly enough. Not so, however the luckless beginner. For the feathering of an arrow is said to be a real art, and certainly is not to be mastered in a day, to say nothing of the jig time that so appeals to the imagination. To my mind it is a matter of much patience added to much knowledge.

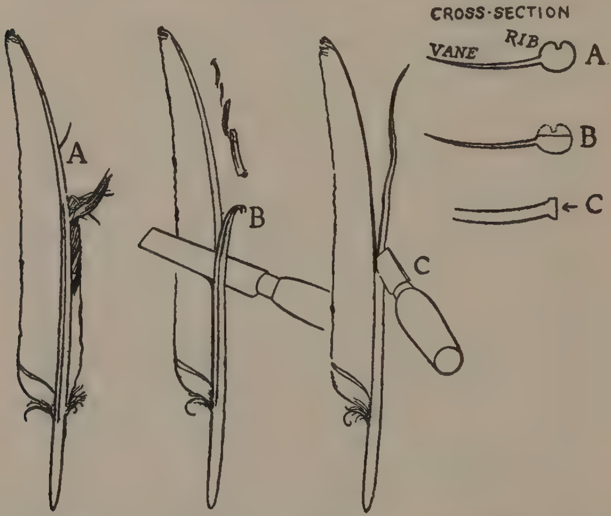
Before taking up the work there is the question of the kind of feathers required, which are the best, and where to get them. Being a recognized fletcher—recognized even to the point of being called "our popular fletcher" by archery authorities who are well aware that fletching is a relatively small part of my trade!—I of course have my own ideas as to what is best and what best to do. If these ideas do not always coincide with those of the authorities, I trust it will be considered that I can but tell what my experience impels me to. There is the question of feathers, and what I have to say on the subject shall not be based on hearsay or general opinion, but upon what my work has taught me.

For even texture, according opportunity to steadily obtain feathers as near to being alike as it is possible to find them, I recommend the so-called eagle pinion feathers. These, I am led to believe, are not from eagles, but instead are the pinion feathers of turkey buzzards. No matter what they are, they stand first in my estimation. They have a very liberal supply of essential oil, which tends to keep them in excellent condition. Thus they are not so liable to fray as are the more handsome peacock feathers. The latter, having almost no oil, are very dry and anything but durable. Feathers from the domestic turkey may well be made second choice, with peacock feathers third, and I should say about the last. We see hen feathers used—and I dare say that if they were available some would even try to use the feathers of the ruby-throated humming-bird! Turkey buzzard feathers, usually sold by feather dealers as eagle feathers, can be obtained only in small quantities. I have at times managed to get as much as 20 pounds of them; but never have been able to keep them any length of time, always having standing orders from other arrow makers for all I can get. Turkey feathers are available at all times from most reliable feather dealers. Peacock feathers have to be imported, and are very expensive. In buying, it is well not to look too closely at the cost. While one dealer may charge 50 cents a pound and another $1.50 for the same kind of feathers, every feather bought at the higher price will be of use, but you may consider yourself fortunate if you can use 5 per cent of the cheaper ones.

In preparing the feathers for use, we professional fletchers do not use the methods usually given in the various books and articles on archery. Simply because we can do it in our own way quicker and better. Not that the amateurs' methods are in any manner to be scoffed at, for each one has much to recommend it. For an example, I shall give one such method, which is as follows: The quill of the feather is gripped in a vise and with a keen knife the major part of the whole quill is ripped off. The strip of quill remaining in the vise, with a vane of the feather attached, is then filed down until it is suitable for use. Then with a bit of flat wood on which is glued a piece of sandpaper the flat sliver of the quill is smoothed out until it is ready for gluing on the shaft. With a pair of shears, the quill is trimmed down to an even narrow width and the feather cut into suitable lengths for use. This ends the preparation. There are other methods, but all amount to the same thing.

The professional first of all selects feathers from either one wing or the other of the bird, never taking them at random from both wings. He sorts them for equal size and sees that none has the fiber stripped. Taking up a feather, with his scissors he trims off the side opposite the one wanted, and snips off any extra quill at the ends. With a knife of the best steel rather thin and very sharp, and the feather laid flat on a hardwood block (lemonwood, beech or any other that has not distinct grain to guide the knife) he splits the quill, trimming down until the desired depth of base for the feather is obtained. Then reversing his knife and holding the feather erect with the quill on the board he cuts the quill to a width of 1/32 inch. This rib of quill holding the feather is ready for gluing as soon as the feather is cut to the desired proportions, about ½ inch high by 2⅛ inches long.

Before the feathers are glued on, however,



Rip off narrow vanes of feather at A. Lay feather flat. With a sharp knife laid flat on rib of feather, pare rib down close to vanes, B. When rib is planed off level with feather, cut it through with a perpendicular blade, C. This leaves a small rib at right angles to vanes for gluing to shaft.

the professional, having an eye for system and efficiency, gives them a softening treatment. He takes a woolen cloth sufficiently large to hold the number of feathers he intends to use, and having soaked this in lukewarm water spreads it out, lays his cut feathers neatly upon one part of it, inside up and never on top of each other, and covers them with the other half of the cloth. On top of the cloth he places a perfectly flat hardwood board, and on top of that any handy weight. In thirty minutes the feathers are straight, soft and ready for use.

Fine feathers are dyed, either to identify the arrows of the individual archer or to improve the appearance. And the cock feather, of course, for ready identification. Here is how the professional goes about it.

In the old days before science came to the fletcher's aid, it was considered a very important branch of the art to be able to make a good job of dyeing. Now it is very simple. We first get a package of Diamond Dye of the desired color, add to hot water according to the directions on the package, stir a little and the dye is ready. Now, however, one must be careful or the feathers will be spoiled. Get your dye made up to the desired color or shade, then soak your feathers in cold water, seeing to it that this is thoroughly done. Shake the cold water out and dip into the dye, which now must be boiling. The dye must be stirred a little, and the feathers removed in less than 10 seconds. Otherwise the hot dye will take all the essential oil out of them. Wash in running water to take off the loose dye, and lay out in the sun to dry and dress.

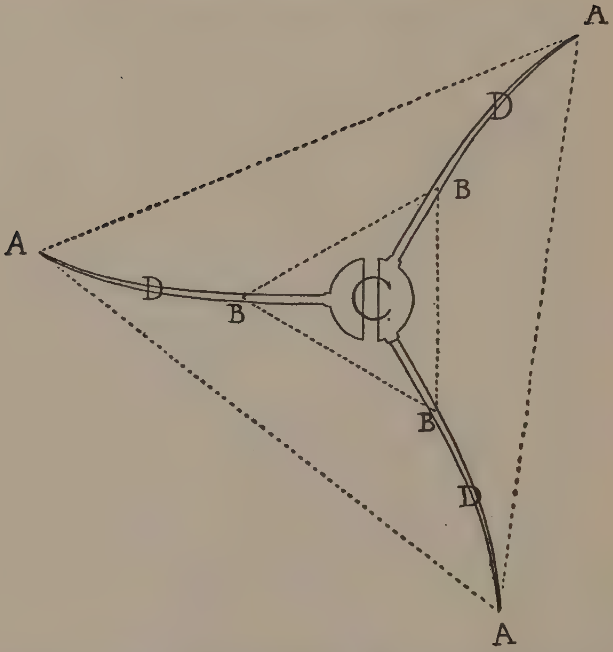
Badly ruffled feathers can be dressed easily, provided the fibers are not broken. Take a teakettle with a little water in it and start it boiling. As the steam comes out of the spout, hold the bruised part of the feather in the steam and watch it dress itself. Then rub it along the side of the hot kettle, using the latter in lieu of a flatiron. It should be a good feather once more.

You can do the same with badly bruised feathers on a finished arrow; but care must be taken that the steaming is not carried too far and the feather removed from the shaft.

For all the fletcher's skill is made much of, there is nothing very difficult about putting the feathers on the shaft. With a little training and reasonable aptitude anyone really interested should turn out good work after a little practice. The two principal things to make sure of are, first that your glue is thin, strong and hot, and next that the temperature of the room is not below 70 degrees—if higher than this, so much the better. The glue must not be allowed to actually chill, or you are likely to spoil a job of feathering.

The beginner will do well to mark off the three positions for the feathers on each shaft, with a pencil mark for the cock or odd feather which is to stand contrary to the direction of the nock. Even thirds is correct for the positions, except the feathers seldom permit the quills to be so placed. The feathers being grown for birds instead of for arrows, refuse to lie alike even when from the same wing of the same bird. Consequently, after sticking them on the shaft the fletcher very often must adjust them in their relation to each other and not by the symmetrical spacing of the glued quills. Only the eye can direct this spacing. And incidentally, here is where the value of keeping the glue pliable for a time comes in strongly; for adjusting the feathers is easily accomplished by pushing this quill or that to one side or the other with a finger nail. (See diagram, page 128.)

Being ready to start feathering, the professional takes up four arrows in his left hand and smears a little hot glue on the feathering part, rubbing it smooth while turning the shaft with the fingers of the left hand, thus providing an even glued surface all around. Then he stands the shafts, nocks up, in a crib or rack for the glue to harden. Meanwhile, he applies glue to other shafts. And having carefully gauged



C is shaft, with perpendicular nock. D are the three feathers just glued to shaft. A are the extreme points which form the visual triangle which the eye fixes for setting the feathers equidistant. B are points of the final triangle formed by trimming the feathers.

his work, he is able to start his feathering and carry it through in the same sequence without the glue getting ahead of him, or becoming too hard. Here is where a warm room is essential. Be sure the worker will be deft and quick even so. For not only must he work against hardening glue, but after taking each feather from the moist press it must be stuck on the arrow and adjusted before the feather itself dries. In this work I find ample time to glue a set of feathers and straighten them on three shafts before returning to the first of the three to look it over and do any final adjusting.

Paper clips and other contrivances may be used as aids in this work. But for the best results they should be avoided as bothersome makeshifts. I have never seen any good in any of such inventions. In England, for example, we had girls and women feathering arrows, some of whom had been at it for years. Their method was to leave the feathers twice as long as required, bind them on at each end with thread, one end loosely, raise the middle and run a glue stick under the quill, then draw the loose end tight and tie, leaving the arrow then for the glue to harden. This method called for marking the lay of the feathers with a gauged marking board, so that every one was placed exactly the same. But they never were allowed to do the work in this way for the best arrows. As I had four women working for me who were good at this sort of work I had opportunity to see the best they could do as to speed—assuming the method to have been intended to save time. But so far as I know the best of them never was able to feather twelve dozen arrows in a day of nine hours, and I can beat that by the old method used by the fletchers for centuries. They used twice as many feathers, and not a little thread, as this could not be used more than once. But of course they worked for considerably lower wages than the fletchers got.

The term fletcher, by the way, is correct as designating one who feathers arrows. This by authority of both old-time usage and the latest Standard Dictionary. Fletching (not fledging, as some have it) was in old times a business in itself.

The arrow being feathered, the next thing is to cut the feathers to the desired shape. That to-day may be anything under the sun. The balloon shape, which is most used, has long been accepted as the best for ordinary shooting, as at the target. And so, although I believe a heavier feather better for the shorter ranges, we will assume the balloon shape is to be used.

Not having a special tool to do the work with, the end may be rounded by cutting with a fair sized carpenter's gouge. Just lay the feather on a block, hold the gouge in position and hit a tap with a light mallet or hammer. Continue the straight cut with a chisel, or else use scissors or a knife. I cannot recommend the latter, as it often means a cutting or drawing pressure across the fiber of the feather. If the work is expertly done, with a curving blade which can be given a rocking motion, well and good. An excellent tool for the purpose can be made from a steel scraper, the blade being ground to circular shape and given a keen edge. It must be rocked in use, not drawn across the feather.

But, some may say, nothing has been said about polishing and varnishing the shaft. They object to having to varnish between the feathers. But I for my part object even more to applying glue on top of varnish. When I am fletching I want my glue to go right on the wood; and if I had to mix the varnish with my glue I would prefer to do it in the pot, and not attempt it by smearing hot glue on cold varnish.

Polishing was touched on in the preceding chapter. And paint, like glue, certainly should be applied before varnish.

The colors to use for the archer's crest, as the paint has become known, is just a matter of choice. But the kind of paints to use seems to puzzle many. Oil paint, enamels, artist's oil paints in tubes, and many others, have been suggested. I have had no experience with artist's oils, but must condemn the ordinary oil paints and enamels. Oil will run, so will turpentine and most other thinners. The only exception I know of is the flat paints that are ground in japan. Touching a feather with paint of this kind will mean nothing, as the color will not run above where you touch it. And it stands the wear and tear, is smooth, makes a fine finish, and except perhaps vermillion, it is cheap.

Gold presents another problem. For many years I used gold leaf alone for gilding. Then I discovered how to use gold powder. The latter always had been easily applied, alike on arrows and on targets; but unfortunately the beautiful gold soon turned to deep brown, and sometimes almost black. It could not stand exposure to the air. By experimenting I found the air could be kept out and the gold powder then answered the purpose of gold leaf. My method is to mix up gold powder with gold size, adding a very little turpentine for thinning when needed. This preparation keeps its original color indefinitely.

For painting arrows, many suggest using a lathe to spin them. There is, however, a better way. Take a board and fit it with a stopper made of a 1-inch strip of hardwood across one end. Provide a movable rest ⅝ of an inch high for the arrow to lie on. Bore a small hole in the hardwood stopper for the tip of the arrow point to rest in. With this simple apparatus painting the arrow shafts is simple. You place your arrow on the rest with the tip in the little hold in the stopper to your right. Paint brush in hand, you turn the shaft with the left hand as wanted, and paint with the right. This is vastly better than a lathe, being so easy to control. It is ideal for striping or hair lines. And by the way, lampblack ground in japan will not spread, and with it and this little painting stand even a beginner can make neat thin lines.

Varnishing with a good transparent varnish is the last thing. For drying, stand the arrows as straight up as you can, on their points, with the nocks resting against a support of some kind, or stand in crib or rack.

Arrows are weighed in both grains and shillings. The latter is the survival of the old British custom. It being as easy to get the coins as it is to get the weights, there is really no preference. The following table, based on weights obtained with new English coins on a tested gold-beater's scale, gives the equivalents:

3d	21–2/3	gr.
6d	43–1/3	“
1/	86–2/3	“
1/6	130	“
3/	260	“
4/6	390	“
4/9	412	“
5/	433–2/3	“

CHAPTER X

SHOOTING

JUST as it is out of the question to lay down hard and fast rules for the archer to follow in making bows and arrows, so is it impractical to set rules to be followed implicitly in order to shoot correctly. Just as trees do not grow alike, so do people differ from each other. And although the majority of writers on the art of shooting with bow and arrow do give specific rules to follow, I believe the exceptions are so numerous that a better way for the beginner is not to depend too much upon such instructions. Each archer is bound to develop a certain amount of his own natural form. To work against this in an endeavor to faithfully follow the instructions that some writer gives, is to handicap instead of to help progress. Far better it should be for the beginner to read carefully what experienced archers have found from long study and practice, and then apply this information as best possible in acquiring some proficiency. If some good archers can be observed in action, so much the better. It is a fact that an archer can learn more from one day spent at a national archery tournament, watching other archers, than from reading all the books ever written. But even in watching others the beginner should not permit himself to become a blind imitator.

The beginner's physique may not be like that of any one of the experienced archers whom he admires. Naturally, therefore, he cannot hope to learn to shoot in precisely the same manner. He is bound to develop his own style to some extent, and he should not discourage himself in this. In the long run his own style may turn out to be one of the best assets he has as an archer.

In this connection, let it be remarked here that among expert archers whose ability is about the same, some will be found shooting in one way peculiar to them, others in different ways. For a specific example, take the matter of the point of aim. But before discussing this perhaps I had better lead up to it with a little preliminary explanation.

If the beginner can refer to a number of pictures of prominent archers in shooting position, he will see that they all or nearly all draw their string hand just under the jaw and directly below the eye. This position—with the bow fully drawn—is known as the anchor. The beginner should make it a rule to adopt as soon as possible a certain anchor of his own. This should be regularly assumed for every shot. Only in this way can the beginner discover his errors and correct them. If a different anchor were assumed for each shot there would be no knowing what was wrong if no success was attained. But with the anchor being constantly the same the beginner soon learns to place his arrows by varying the point of aim and improving the loose. The loose, by the way, is the precise manner of letting go the bowstring in shooting.

Drawing each arrow the same, having established a permanent or perpetual method in shooting, and practice having improved the loose, attention to the point of aim becomes uppermost. And now here is where archers are prone to differ from each other. In shooting, each arrow describes an arc in its journey from the bow to where it falls. The trajectory is the height of the curve of the arrow above a direct line from the shooter's eye to the target. This is determined by two things; first, the cast of the bow; secondly, the loose of the shooter. The same bow and arrow may be used by two equally good shooters, and yet it will be noticed that one will put a higher curve on his arrow than the other will. Assuming that they both hit the mark, one may shoot the arrow on a curve which will be fifteen feet above a direct line at the apex of its flight, where the other shooter will send his arrow on what apparently is almost a perfectly flat flight.

With this introduction, let us get to the actual shooting.

First, how to stand. The generally accepted position is facing nearly at a right angle to the target; that is, with the left shoulder pointing at the target. Thus when the bow arm is extended it points nearly straight sideways, and right out level with the shoulder. Actually, the bow hand is held about a foot forward of a direct line across the shoulders of the shooter. Otherwise the position would be strained, especially the neck muscles. We are told that the great advantage of this position is, it minimizes the natural tendency to move the bow arm toward the left immediately upon releasing the string; this being quite a common fault not only in beginners but as well in experienced archers. The result of it is, more arrows pass along the left side of the target than get over on the target or to the right of it.

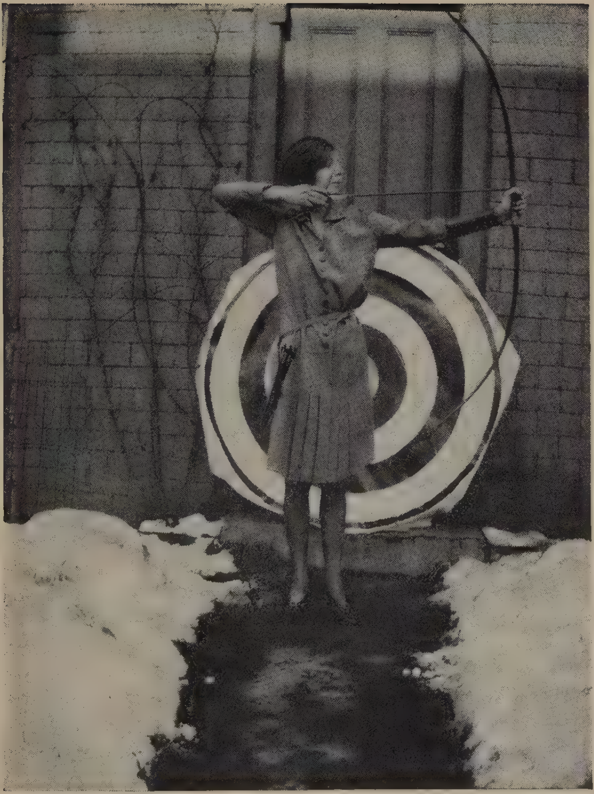
However, my observation has led me to believe that while this may be the best form it is not absolutely demanded, as sometimes the best archers take the poorest position in shooting, far from the spectacular position which this style of shooting tends to cultivate. Nevertheless, the beginner will do well to adopt this position. Certainly there is none better to recommend.

The beginner will have to practice a great deal to become proficient in making the release, or loose, as nearly the same as the last one as possible. He will do well to use three fingers for drawing the bow, even though most archers feel that the third is somewhat in the way at times, as it seems to take the greater part of the load in drawing the bow up.

Now once more let me mention the anchor. The shooter should early find his own particular anchor, and use it regularly. I reiterate this purposely. Nothing is of greater importance to making progress than to get a fixed anchor and use it regularly. This simply means finding a place as near to directly under the eye as possible where the nock is to be drawn regularly. This in order to give a direct line between the nock of the arrow and the point of aim. This anchor should always be below rather than even with the chin. Practice will soon educate the shooter as to just where it should be.

Most pictures of archers of long ago show the arrow being drawn to the ear or thereabout, but it may be some artist took the liberty to set this style in pictures. It is bad form in archery to-day, for it tends to throw the arrow off the direction desired. Nevertheless, if accurate allowance can be made for the arrow being thrown to one side, there of course is no reason why good results should not be obtained by this method. Again, archers have been known to draw the arrow to the chest, in order to get elevation at the longer ranges. The only objection to this method is the draw is liable not to be always to the same precise point. There would be no harm, however, in having a mark of some sort there for the thumb to find.

Some beginners in archery who are familiar with firearms have the desire to look along the shaft in shooting. This is impracticable of course, except at very close ranges. Something is to be said too against closing one eye in order to sight, in holding the point of the arrow on the point of aim. However there is no harm in it if the shooter insists and sees as well with one eye as with two. If he shoots better that way, who can object to it? We must take into con-



Miss May S. Duff received four lessons from her father, practiced for six weeks, and won fourth place in the championship meeting at Bryn Mawr, Pa., 1926. Fairly good position or stance.

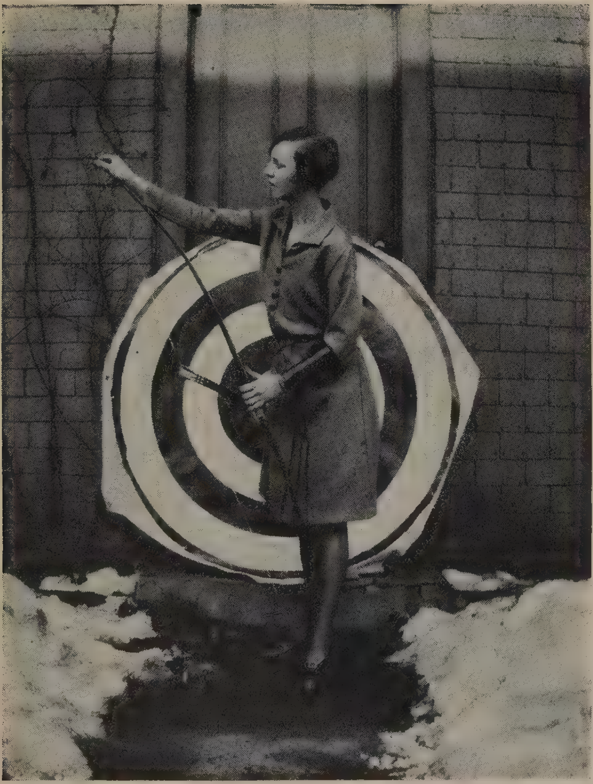
sideration that the eyes of no two individuals are apt to be just alike, and we must remember that each archer will surely do best by what best suits his particular case. In shooting at a moving target, as in hunting, then both eyes open should be the better way as the shooter will have a wider range of vision, and perhaps a little clearer. But there seems to be very little sound objection to one-eyed shooting on the target range, except that closing one eye is needless.

Now let us pay attention to stringing the bow. To the writer, it has always seemed peculiar that most archers place the lower end of the bow in the hollow of the right foot and notch the string with the left hand. As the majority are right handed, this has always seemed to me to be awkward. However, perhaps I am wrong, as there must be some rather weighty reason why so many do it that way. My own method is as follows: I place the lower end of the bow in the hollow of the left foot, taking care that I place no strain on the horn. I grasp the handle lightly with my left hand, place the flat of my right hand on the back of the bow just under the eye of the string, and exert my weight on the top limb. When this bends sufficiently to allow slipping the string into its place in the top nock of the bow, it is done with the thumb and forefinger. By the way, the fingers never should be allowed to get under the string just at this point, especially if the bow be a strong one. If the string does not cut the fingers, at least the archer will receive a rather painful lesson in stringing the bow.

Some archers recommend the reverse method. While holding the bow in the same manner, this is to grasp the handle firmly and draw it toward you, simply holding the upper limb until the string can be inserted in the nock. There really seems to be very little difference, except I believe less exertion is required as I do it.

A bad habit to be avoided which I have noticed in connection with the stringing of strong bows, is that of placing the knee behind the bow and assisting the hands with it acting as a lever. This will eventually end in destroying the lower limb of the bow, as the bending is not equal.

With the bow strung, or braced, as it is called, we again take up the subject of drawing. Taking his stand before the target and placing the arrow in its' proper position, the shaft to the left of the bow and resting on the knuckles of the left hand, and the nock in its proper position on the string, the archer is ready to draw.



Miss May S. Duff stringing bow.

Before doing so, it is advisable to take a look at the proposed point of aim. This in order to prevent a search for that valuable aid while holding the bow fully drawn. The point of aim, it must be remembered, very likely will not be the target itself. The beginner will find it a help to have some marker, such as a golf ball, to put on the ground between him and the target, for his point of aim. The placing of this guide will govern the length of the arrow's flight, all other things being perfect.

Raising the bow arm, not with a rush nor yet too slowly, and adjusting the string hand to its proper anchor, and simultaneously turning the bow vertical, the archer sights the point of the arrow until it rests on the point of aim. Then the arrow is released, and if the shot has been well made, presumably goes to the mark. Here are the requisites for a well made shot:

First, the bow arm must not waver at the moment of delivery.

Second, the loose must be a perfect one.

Third, the point of aim must be in the correct place.

Fourth, the arrow must be properly drawn.

With these the archer will have attended to the principal points that go to make good shooting; but he will not by any means have approached any of the refinements requiring attention if he has championship ambitions.

Take the matter of holding the bow. Two great archers differ on this. One makes the statement that the archer should squeeze the handle as if he would crush it, and the other, a champion many times over, states that he holds the bow loosely in the hand with excellent results. Here again, you see, it is futile to lay down hard and fast rules for shooting. What answers perfectly for one man will not fill the bill for another. It is safe to say on this point, however, that an average grip that gives complete control of the bow at the moment of release is perhaps the best for the average shooter. Such a grip is used by the great majority of really good archers.

The proper position for the arrow to ride as it leaves the bow, is directly above the handle and not on the handle. The correct nocking place on the string is something to establish and use regularly. It is a good plan to add a little colored silk to the whipping on the string on each side of the nocking place. To locate this nocking place on the string, take a carpenter's square for a guide and, with the bow braced, place a mark on the string directly opposite the riding place of the arrow.

The odd feather on the shaft, or as we call it in archery, the cock feather, is always placed so that it will not touch the bow in passing. As previously remarked, this feather usually is of a distinctive color so as to be easily recognized. Where the feathers are all of the same color, as in peacock feathers, the cock feather is easily found by looking at the nock, being directly at a right angle to the direction of the notch.

In drawing the bow the archer takes the nock of the arrow between the index and second fingers, holding the nock lightly. The fingers must be bent sufficiently to enable drawing up the bow, but never should be hooked too much. The third finger is commonly used to help in drawing up the bow, but there is some objection to its use among the skilled archers, the reason for which has been given previously.

The release as ordinarily used is simplicity itself, but the perfect release is an art to be acquired. There are two methods known as the slip loose and the snap loose. The latter is accomplished by drawing the arm back somewhat smartly as the fingers are loosed, thus in a manner giving a snap to the release. The slip loose is accomplished by opening the fingers, and is the easiest of the two to acquire. Each archer will have to determine for himself which is the easier to accomplish and which produces the best results as far as he is concerned. To simply open the hand, or rather extend the fingers sufficiently to allow the string to slip off the fingers, is claimed to be slow. To snap the fingers off without taking the hand away from the anchor is claimed to be much the better method, and especially makes for a decidedly lower point of aim. The latter, by the way, is something which the average archer is always in search of, particularly when shooting at the longer ranges.

Perhaps it is well to add a few words of explanation on the point of aim. This, in effect, calls for shooting by the method which in artillery fire is known as indirect firing. Supposing an archer stands 60 yards from his target, he may place an aiming mark on the ground at a distance of 50 yards from him. This mark, of course, is directly in line with his target. In shooting, having nocked, swung his bow from horizontal to vertical and drawn up his arrow to the head he will slowly raise his bow hand until the point of the arrow reaches that mark which he has placed on the ground 10 yards short of the target. That will be the aim at which the arrow is loosed; the line of sight is directly from the shooter's eye across the point of the arrow to the aiming mark placed on the ground at 50 yards. Now, assuming that the arrow hand is always drawn to precisely the same anchor at the shooter's jaw, it will easily be understood that the distance shot will be regulated by the elevation of the bow hand. Therefore, it will pay the beginner to give early and close attention to the exact elevation given the bow hand; that is to say, he must acquire absolute regularity of elevation while continuing to shoot at the same mark for the same distance.

Some archers claim that the rules should prohibit using any artificial aid such as an aiming marker. These, however, will invariably be found to be the fortunate ones who have the inborn judgment which enables them to shoot well without the use of a marker. No good archery association will ever be found willing to enact rules for the special benefit of the few members who are so favored. On the other hand, the purpose of every one interested is to encourage success. And surely the great majority of shooters will agree that the use of an aiming mark is a valuable aid to them in target shooting.

A substitute has been introduced, in the form of a peep sight. This is a piece of wire or other metal attached to the bow, which is adjustable and actually after careful experimenting can be placed in the exact position required for shooting at certain distances. There have been objections made to the use of these sights, but they cannot fairly be prohibited. Indeed, to rule them out would be a reactionary step deserving of every archer's condemnation.

It may be just a coincidence, but it has been noticed that since the introduction of the use of the marked point of aim, mentioned by Horace Ford of England, archery in this country has improved to a marked degree. To-day American archers rank as the best in the world, taken as a class. And the great revival of interest in the sport is due, not to blindly following timeworn practices, but very largely to the exercise of intelligence in developing the sport in keeping with the times. Those who object to such valuable improvements as aiming marks and peep sights cannot be said to have the best interests of archery at heart. And it is altogether wrong, too, to assert that these are artificial aids to shooting. Without doubt, the principle of indirect aiming was known to many an archer before Ford. And as for the peep sight being a mechanical contrivance, there is in fact nothing mechanical about it;

it plays no part whatever in the actual handling of bow and arrow.

Shooting to the left is a sore fault with many a beginner, and with some oldtimers too. The old hand, however, has the advantage of knowing what is wrong and how to get out of the trouble. The beginner is not so well off.

An experienced archer can detect the trouble by watching the shooter in action. He may try the arrows, and find them weak in spine. The only remedy for that is for the shooter to make the necessary allowance to compensate the throwoff. Or he may detect the shooter in some error.

Throwing the left hand as the arrow is released, which also causes shooting to the left, is common in beginners. It can be permanently cured by concentration and careful practice. Yet I have often watched archers shooting at a mark placed several feet to the right of the target rather than go to the trouble to cure themselves of a bad habit. No good archer will ever advise such a lame expedient.

Drawing the right hand away from the anchor position simultaneously with the loose likewise results in shooting to the left. The hand should not leave the face during the release, nor immediately afterward.

The right arm should be held horizontal not only when the string is drawn but it should be kept right there until the arrow has sped beyond the bow. To drop the arm will probably put the arrow over the target, while to advance the arm may cut down the flight to half the distance.

Pinching the arrow is a habit at times acquired for no apparent reason. It shows up promptly enough in the trouble the shooter has in holding his arrow in position against the side of the bow. The habit is not easy to overcome; except that if much shooting is done it sometimes results in a corn between the fingers just at the side of the nail which becomes rather painful and is about as good a cure as any. A pinched arrow means a bad shot in most cases.

CHAPTER XI

ACCESSORIES

UNFORTUNATELY, outsiders are prone to look upon the archer's glove and arm-guard as a sort of affectation. Not a few beginners expect to get along very well without them. Here and there one encounters a horny handed individual who tells that he works with his hands and therefore needs no such protectors. He confidently starts out with his shooting, but very soon is seen to be wincing from the punishment given his forearm by the bowstring. If he is wearing a coat, we see him trying to pull the sleeve down to protect his wrist. And he very soon conceives the idea—by no means an inaccurate one—that the sleeve is interfering with his accuracy. Right there he begins to talk about an arm-guard, and eagerly accepts the first proffer of the loan of one. But his real trouble is yet to come. As he goes blithely along with his shooting, before long he raises blood blisters on the fingers of his string hand. So far as I know, no archer has succeeded in shooting for hours at a stretch and with no protection for the fingers of his string hand without paying this penalty.

Dealers in archery goods offer a large selection of finger tips, as they are called. These were at one time known as knuckle tips. I have never been able to learn where this latter name came from, as they were in fact finger stalls, the term finger tips also being a misnomer. Finger tips are made from good leather, having a fine facing, and are worn on the three used fingers of the string-drawing hand—just good, heavy finger stalls. Get them of good quality and the proper fit, and they protect your fingers just about as well as anything can. Unfortunately, though, it takes quite a little time for the beginner in archery to become accustomed to using them. Some say that they fly off along with the arrow altogether too easily. Naturally they will if too loose. Some archers seem to find it impossible to get a proper fit—are always fuming about their tips. This difficulty should quite easily be overcome. In choosing a set, one should pick those which are too tight and thus prevent pushing the fingers in all the way, then place the set in hot water to soak thoroughly, finally stretching them onto the fingers, molding the leather by working it vigorously with the free hand. After manipulating the wet tips until they fit perfectly, remove them carefully and lay them aside to dry where they will not be disturbed. When dry they will retain their shape for a considerable time, and give good satisfaction in shooting.

A glove is just as good; but I never favor the heavy buckskin that is chosen by some. It is a mistake to have the finger tips or the fingers of the glove too thick and cumbersome. Much better get an ordinary kid glove that has been well broken in without damage to the three important fingers, and reinforce the fingers. The reinforcing should cover the fingers on the front and sides; the best material for this is Russian leather. This is smooth, not too hard, nor yet too thick, and is easy to work. Still, it takes a rather neat hand with the needle to apply these facings satisfactorily. Special care must be taken to prevent any pucker coming on the inside surfaces between the first and second finger, which hold the arrow on the string. Nor should the leather be too thick at this place. The archer's fingers must always feel the arrow sufficiently to enable holding it without pinching.

Another form of protection for the fingers of the string hand is called a tab. This is a piece of leather, cut to form a protection for the entire three fingers, and slit to enable holding the arrow on the string. Some archers prefer these tabs, and certainly they insure more delicate holding of the arrow. They are, however, rather clumsy, it seems to me.

The only objection to using a glove is, it encloses the hand and is not comfortable on a warm day. Some archers get around this by cutting away the thumb, palm and part of the back of the glove, leaving only a skeleton with three fingers attached.

The bracer, or arm-guard, although scorned by some archers, nevertheless is desirable equipment. Dealers in archery goods have them in various attractive styles, but practical utility should govern the choice of one. Any good piece of stiff cowhide with a smooth surface, and cut to the proper shape, will do when provided with eyelets for lacing it on, or some other fastening that suits the archer. Whatever form it may be, the fastening must be well on the back of the bow arm, as nothing may be allowed to obstruct the bowstring when the shot is made. It may seem strange, but it nevertheless is a fact that if the string is interfered with a wild shot will be the result. So the arm-guard must fit snugly, and have a smooth surface. It must not reach as low as the wrist, nor come up to the elbow joint. The arm must have freedom.

The quiver for the arrows, and a cover for the bow, may be anything that suits the archer's fancy. There is plenty of variety to choose from, at prices to suit all pockets. Though not commonly used, bow covers are very desirable; for if they do nothing else they keep the bow dry. I consider the best bow covers are those made of automobile top material—simply a long tube with a flap cover at one end fastening with a strap and buckle.

There are, by the way, quite a lot of good archers who will not use a quiver in connection with target shooting. They find it bothers them, and like better to lay their arrows out conveniently on a rack placed in front of them. A popular form of receptacle for them is a holder for fishing rods, made for salt-water fishermen in connection with surf-casting, where it is detrimental to the reel to lay the rod down in the sand. These holders are thrust down into the ground and hold the arrows upright, as in a vase.

To the beginner who is unfortunate in not being associated with other archers, the thought of buying a specially made target is rather unattractive in the initial stage of his interest. He thinks he would rather get some practice at some sort of a makeshift; but it is not often that he hits upon the best one. This is nothing other than baled straw or hay. The cost of this is attractive, in comparison with the prices of targets seen in the archery goods catalogs.

To get the best use out of baled hay or straw, pile it up to form a regular butt, and fasten the target cover on this. To make a good butt, have a light frame of wood and stack sections of the bale or bales up against this, flat sides on, and secure these by roughly binding them on with twine. For the best results, the frame must be propped so as to slant backward a little, when the weight of the packed hay or straw will anchor the structure better. Such a butt will stand a lot of shooting. Keep it covered with a tarpaulin between-whiles.

It is possible for anyone to make a regulation straw target, but it is far from a light job. In the first place, assuming that your time and labor are worth consideration, you want good straw to work with, so the target will last. Hand-threshed rye straw is the proper thing—and that may be as hard to find as a volunteer target maker who has had experience in the work! Machine threshed rye straw, if of good growth, is by no means to be sneezed at. Next in order comes good wheat straw, the last oat straw. Marsh hay, especially the salt-marsh kind, should be better than oat straw, and so should good timothy hay. But to go back to machine-threshed rye straw, let me say that an important consideration to the target maker is the workability of the material he is called upon to use. Machine threshing crushes rye straw very desirably, from the maker's point of view, and it does not materially reduce the shooting life of the target, either. As for making a target of salt-marsh hay, I should prefer to be excused. I fear I should find it too difficult to handle. If the reader has ever visited a horse-collar factory, and seen the collar makers at work on rye straw, my objection will be sustained. It is the same horse-collar makers, by the way, even in these days of motorized traffic, who are responsible for rye straw being so scarce—they and prohibition!

Before telling how to make a straw target of regulation style and shape, let me warn the reader that it is the most laborious work done in connection with the making of archery goods. Next, let me caution against the spurious advice that the straw is easier to handle if wet.

Though it softens the straw, and thus expedites the work and saves some effort, dampening swells the straw, and when the target is finished and laid aside, it dries out soft. A soft target is an inferior one. For another thing, the wetting starts the straw on the way toward rotting —and the time will come soon enough when the archer will really need to wet that same target. When a target reaches the stage that it will no longer hold an arrow, it can be tightened temporarily by wetting it. So do not dampen your nice new target straw.

If I may interject some more comment before describing the making of this target, let me add that it is not the shooting that wears out the target. It is the handling. Dropping the target, tossing it about, and particularly rolling it wheel-fashion, are the real sources of wear and tear. For long life it should be given very careful handling, and transported flat.

Usually it will be necessary to buy the straw in a bale. In this case, very often the nicest looking bale of straw will be found to contain a lot of trash in its interior. But no matter, and admitting the fact that it costs three times per hundred what it did ten years ago when straw was very much better, still there must be some straw. The thing to do is to get it and go to work with it.

Take a handful of carefully drawn straw, which as held is not less than five inches in diameter, and proceed to crush this and at the same time bend it upon itself in the manner of a clockspring, holding the stout wisp together by binding with twine, and sewing in the spiral as it grows around its center. As your first strand of straw begins to thin out, you must add more, always binding, crushing, compressing, bending and sewing. Of course, feeding in more and more straw is necessary, in order to prevent breaking the continuous band. Always, the straw must be very solidly packed, and laid so there is good continuity of long, strong stalks. The binding must be well done, and the turns firmly sewed together. The standard dimension for the completed target of straw is not less than 49 inches diameter, and the thickness must not be less than 4 inches. The face of the straw must be large enough to enable spreading thereon a regulation target facing of 48 inches.

After making one target, few archers will care to undertake making another. It is not only a mighty hard job, but as well a thankless one in the average small club. Really, it is a job for a machine; yet there is no machine for the job, so far as I have heard. We are told that it is work that can be done by blind men. I have never heard of a good target being so made, but I have heard that the cost is increased 50 per cent.

Any kind of string may be used in the sewing, but it will be well to select a strong kind made of fibre and not cotton string. The kind I use is Aslath yarn. This is strong, cheap and rot-proof to a large extent. A target can be made to last by giving it occasional attention, and tightening the sewing.

The target facing should be painted on sign-writer's muslin or cloth. This material is easily obtainable, and the cost for a single target face will be about 70 cents. It can be had in various colors. I always use white, as it saves painting the outer ring. The rings are laid out by placing a tack in the exact center, attaching a length of twine to this, making a loop in the twine at the proper distances and scribing circles with a pencil or with compass. The diameter of the center ring must be 9 3/5 inches, and the width of each additional ring 4 4/5 inches. The center is to be painted gold, and the others, naming outward, respectively red, blue, black and white. For the gold, do not use yellow paint; it is cheaper and better to have the standard gold finish. This can be easily produced with gold powder mixed with gold size and thinned with a little turpentine. Avoid using banana oil or other preparations already made up, in mixing your gilding, or your gold will soon turn black. The red should be a true scarlet and never a dark red. The blue should be a light blue, never Prussian blue. Enamel colors or oil paints should not be used, as they will shine and reflect the sun in a very bothersome way. The colors should be flat and ground in japan, never anything else. For the blue I have had to make up my own, as I have not found the right shade in a flat paint ground with japan. I use the best white lead with a little turpentine, and tint with Prussian blue to get the right standard target blue shade.

For the target rack, use light pine or spruce and never iron in any form. Simply make a light tripod, with two legs to the fore and one as a rear support; all attached at one central point. Just hang the target on this tripod, resting on the outer staves—which by the way are to be 6 feet long. When properly hung the bottom of the target will be 2 feet above the ground.

CHAPTER XII

STANDARD COMPETITIONS

COMPETITION is what makes archery a sport. Naturally, there are certain standards by which proficiency is measured. The oldest of these standard competitions in use to-day, and the leading competition too, is the famous old York Round. This old standard, set long ago by the leading archers of Great Britain in the heyday of archery, has been accepted for so long that it has become as unalterable as the laws of the Medes and Persians. It is the competition which best brings out the real ability of the archer. Certainly anyone who can shoot through the York Round with credit to himself is entitled to proclaim himself a finished archer.

The York Round calls for shooting at the standard 48-inch target as follows: 72 arrows at 100 yards, 48 arrows at 80 yards, 24 arrows at 60 yards; making a gross of arrows shot in the complete round.

The standard system of scoring is as follows: Gold, 9, red, 7, blue, 5, black, 3, white, 1. Totals are counted in two ways; that is, the hits are totaled and the score is totaled. For example, let us take the classic Double York Round world record made by Horace A. Ford away back in 1857, still a world's record at the time of writing this. The score is 245-1251, which means 245 hits with a total valuation of 1251. Analyzed, it means that out of 288 shots made at all distances, he got 245 hits, the average value of which was 5.106, which means the hits averaged in the blue ring with a few cutting the red. Archery scores are not so analyzed; but this gives the uninitiated a better idea of the scoring. The point is to understand what the *possible* score is. In the case of the Double York round were it humanly possible a perfect score would be 288-2592, or a hit with every shot and every arrow in the gold, each counting a 9.

An arrow which cuts two colors counts on the inner color.

It is customary for each archer to shoot three arrows, and then permit someone else to shoot in turn. And it is a rule that an arrow which has left the bow must count as a shot arrow unless the archer can reach it with his bow without moving from the shooting line.

The American Round, adopted in the early days of archery competitions in this country, is by far the most popular. It is especially attractive to beginners, being so much less difficult than the York Round. Something else to be said in its favor is, it places average archers on an equal footing. The longer ranges of the York Round make an archer so extend himself that the man in best physical condition reaps advantage from his athletic superiority.

With the weaker bow used at the shorter ranges of the American Round, and the smaller demand upon accuracy (the longer the shot the greater the test of accuracy) success is comparatively easy. And still, there always is opportunity for proficiency to excel, and this is as it should be. And when the archer tires of the shorter ranges, as he soon does once he acquires a good degree of accuracy, he has the York Round ahead of him. When he graduates to the York Round class, he thereafter is more often than not to be found pegging away at the 100 yard target.

The American Round calls for shooting 90 arrows at the standard target, as follows: 30 arrows at 60 yards, 30 at 50, and 30 at 40.

A rule which some beginners find strange is that an arrow that passes through the target or rebounds from any part of it scores a hit and counts 5. Why such a hit is given so favorable a score is hard to explain; but there is good reason back of it just the same. If the arrow passes through the target in the gold the archer is penalized 4 points; never mind why. If it passes through the target at the white ring, he is favored to the extent of 4 points. If it strikes the target and bounds off, leaving a question as to where the point struck, it counts 5. And the long and short of it is, the seemingly queer rule is to give credit for an average shot. However, I never have been able to understand why a premium is placed upon shooting through the target, nor yet for penalizing it. The softer the target the more likely it is to occur, and then the accurate man is up against it, while the fellow who just manages to get on the target is in clover.

While I am on this subject, it is well to point out that the target face should in all cases be made amply large so that the white ring will not bend around the outer edge of the straw. The entire counting surface should be flat and directly presented to the shooter. Otherwise some counts of 1 surely will be lost. And although this may be as fair for one archer as for another, it is discouraging when it comes to comparing scores against other archers' scores made on properly made targets. All tournament targets have an additional hitting surface ring outside the white ring. These are called the petticoats, and have no counting value.

The National Round is a competition for women and girls, and calls for shooting 72 arrows as follows: 48 arrows at 60 yards and 24 arrows at 50 yards.

The Columbia Round calls for 72 arrows as follows: 24 each at 50, 40 and 30 yards respectively.

For shooting at the American Round, where 60 yards is the limit, a bow of 45 pounds draw is about the heaviest that should be used. With this comparatively light bow, the archer can reduce the weight of his arrows to 4/6. Incidentally, this is the lightest arrow that should be used at any range.

Although there are many different rounds having short ranges, there is no reason why adults of the fair sex should not shoot at 60 and 50 yards. The latter is well within steady reach of any woman or big girl.

Among the large variety of competitions, one which must not be overlooked is the Metropolitan Round. This is used for the championships of the Metropolitan Archery Association, which confines its membership to archers and clubs residing and located within a radius of fifty miles around New York City. It calls for shooting 150 arrows at the standard target as follows: 30 at 100 yards, 30 at 80 yards, 30 at 60 yards, 30 at 50 yards, 30 at 40 yards. The particular advantage of this round appears to be that the archer is not put to the test of a long grind at 100 yards, yet is given opportunity to show what he can do at this extreme range. Another point worthy of mention is the fact that the last three distances make a complete American Round.

Organized archery so far has not recognized the junior archer. However in this country, as in Great Britain, we have the Boy Scouts organization, taking an interest in archery. It has been my pleasure time and again to address Boy Scout troops, also meetings of Boy Scout officials. I believe the Boy Scout movement is capable of doing a very great deal to inculcate interest in archery, and for this reason I hope to see the national organization of the Boy Scouts revise the rules which at the time this is written still govern the award of its merit badge for proficiency in archery.

To qualify for one of the three tests, the rules require the Scout to make his own tackle. So far well and good; this I heartily approve, as no hardship at all. But I do consider it very much of a hardship to require the boy to perform the impossible with his home-made tackle. People who know nothing about archery, thinking of the boys in the smaller country communities as possibly having some advantage in being able to go out into the woods and "cut their own bows and arrows," may feel that any rule requiring the boy to make his own bow and arrows is a good one because it compels the city boy to get out into the woods, and that is supposed to be good for him. But in the present case such reasoning could not apply. The fact is, the city boy is just as well fixed as the country boy, when it comes to getting hold of the proper materials for making the kind of bow and arrows that are required to pass the flight shooting test and win a Boy Scout merit badge for archery. For with his bow and arrows of his own make the Scout is required to shoot an arrow 150 yards. No average boy, equipped with average tackle of his own make, can ever hope to pass this test. It automatically rules out all except the largest and strongest, equipped with exceptionally good bows and arrows. Oddly, in the target test, at 60, 50 and 40 yards, *any* kind of tackle is allowed, yet the scores required are easy for any boy.

In connection with the National and the Eastern Archery Association's tournaments, there has been for many years a competition consisting of shooting so many arrows a distance of 180 yards. This is but 30 yards farther than the Boy Scout is required to send his arrow, with tackle made by his own hand—doubtless this includes the bowstring. This competition I have mentioned is entered by many archers long accustomed to shooting at target range of 100 yards. Nevertheless, it is a common thing to see not a few of these mature adult shooters drop out of the competition, declaring that it is no use to make the effort as the distance is too great for them. And we must remember, in practically every case they will be found to be shooting professionally-made target bows and some even special flight bows.

If the real archers balk at 180 yards with the best equipment obtainable, then I say the distance for the Boy Scout should be 120 yards, and no more. While this would be easy for the big boys with plenty of brawn, it would not be beyond the smaller ones. And what good can the test be unless it offers encouragement to all to become archers?

Still another requirement placed upon the boy in order to win this badge of merit in archery is, he must learn the names of all the past champions and their scores. I am willing to bet that there are not three men in the two archery associations who can pass this test. I question if there are six archers in the entire country who could even guess the record score made by Dr. P. W. Crouch this year. It is a requirement having no useful purpose and should be abolished.

Everything that is a detriment to this fine old sport should be thrown out. But no one is going to take the bother unless he is interested, and so I say that the real archer will do well to go further than to merely serve his own interests. Everything having to do with archery should be in the hands of practical archers themselves, and then we shall have no more of these obstacles thrown in the way of the sport.

In my own case, I suppose I have been very fortunate. From boyhood I have been consulted about archery, by all sorts of people, from the littlest boys of the neighborhood to the most famous archers from all over the world. Big and little, they have come to my shop, and they have written me seemingly bales of letters. Always it has been a joy to me to pass on information asked for, and to throw in a good measure of enthusiasm to boot. I recall the children perhaps best of all—their eager little faces, looking up at me all through the years, fascinated by the man who was in some way connected with the stories newly read to them of archers bold in the days of old. Robin Hood! Rob Roy! Locksley! King Arthur! Romantic names indeed, and a romantic sport it always is to young and old. I never tire of being questioned and stared at, for somehow all my life I have felt that my work has been a tribute to the memory of those great men who dignified archery by their part in it in the time when it meant so much in the affairs of the day and the destiny of the world.

I confess my interest never has extended to archery for the original use for which it was devised, killing. I have studied all kinds of bows and arrows, and found much to interest me in those made for warfare and for hunting. At one time, in company with Sir Ralph Payne Galway, I visited various museums to learn about Turkish bows, and you may be sure those we were permitted to examine were never made for target shooting. I subsequently made several such bows for Sir Ralph, and he used them for target and flight work. At another time I was called upon to set a stage piece for the Merry Men of England. Again, I was given the task to produce a bow that would bend to the full draw and yet be safe to shoot on the stage, at a distance of only 40 feet—and always hit the mark, so as not to endanger the stage folk. This I did for Lewis Waller to use in his play "Robin Hood," and it was a success too. In fact, I have had to do with as great a variety of work in connection with archery as perhaps anyone in the last hundred years. I have read a great deal on the subject, attended many tournaments, of all degrees of importance, have won some honors with the bow myself, even to the extent of being high man on more than one occasion when the company was neither scarce nor mediocre in shooting ability. I have been consulted and visited by the leading modern exponents of hunting with the bow, and by no end of archery goods merchants, makers and manufacturers. And after all is said and done, I am sure that it always has been and always will be the sport, the competitions in target shooting, that has held my interest, and will hold it, above all. The association, the fellowship of the archery fraternity, and the spirit of true sportsmanship pervading the tournaments, I am sure cannot be excelled in any other sport in the world. And this, I may add, is as it should be; for if there is any other sport which preceded archery in popularizing the exercise of true sportsmanship I have never heard of it.

It has been a real privilege to serve such a fine class of people as the archers who shoot for sport, and if I were to start all over again I could want for no more pleasant means of livelihood. But as for writing about it, I must confess this book has been the hardest job of my life. And so, to the reader who has not already made their acquaintance I would say, by all means read the books on archery written by Samuel G. McMeen, Dr. Robert P. Elmer and Dr. Saxton T. Pope. Even though for some unaccountable reason all were written by doctors, they are, I assure you, vastly better books than I ever thought they were before I undertook to write this one. For real enjoyment, I want nothing better to-day than to sit down with one of them before me, to picture for me the sport to which the good doctor, whichever one it may be, has given so much devotion purely as an avocation. I would that I had the gift to have put into this book of mine something of the same fine flavor, if for no other reason than to give similar pleasure. Not having it, the least I can do is to commend these really excellent works on archery.

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